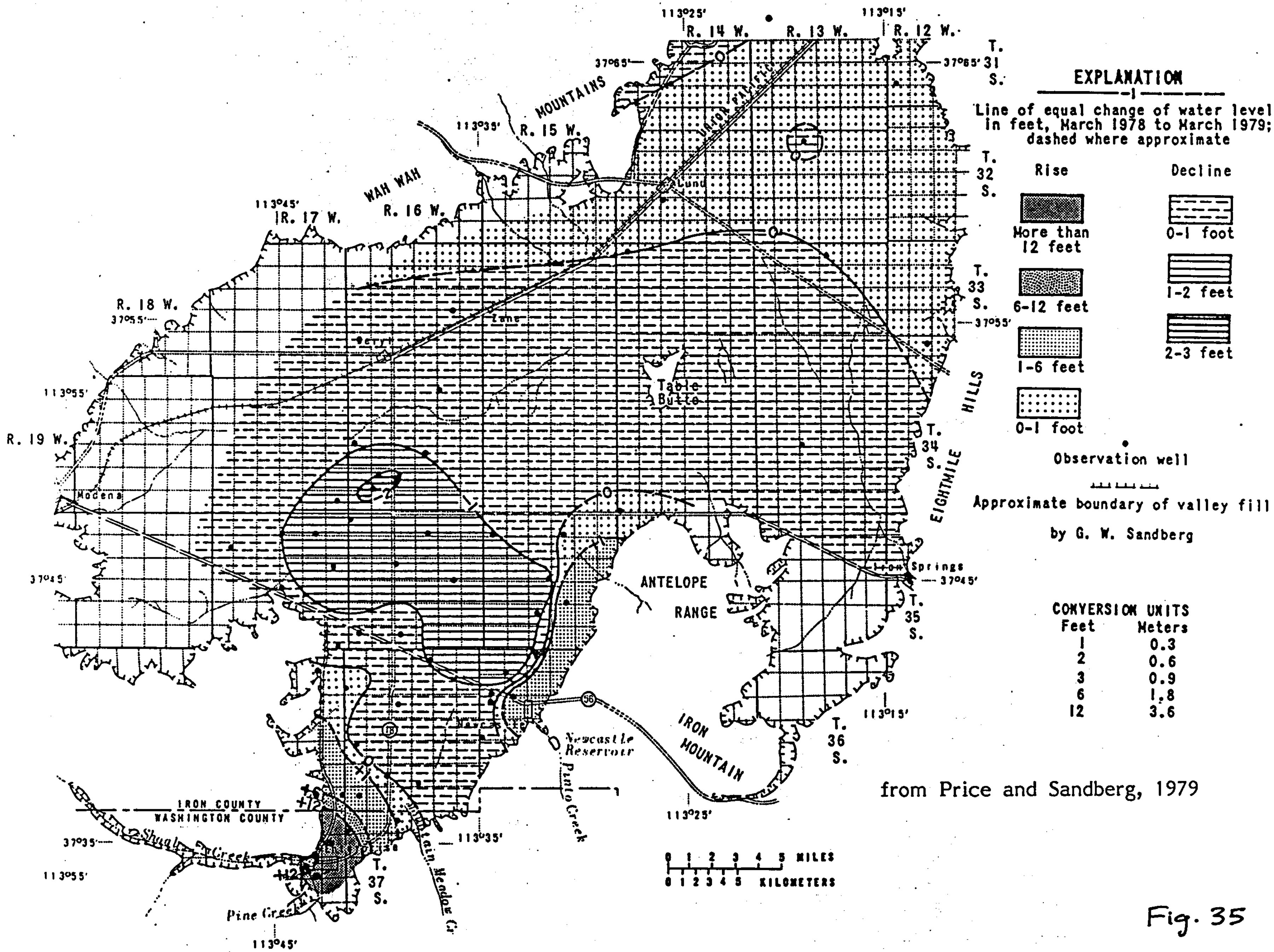


from Price and Sandberg, 1979

Fig. 35

—Map of the Beryl-Enterprise area, Escalante Valley, showing change of water levels from March 1978 to March 1979.

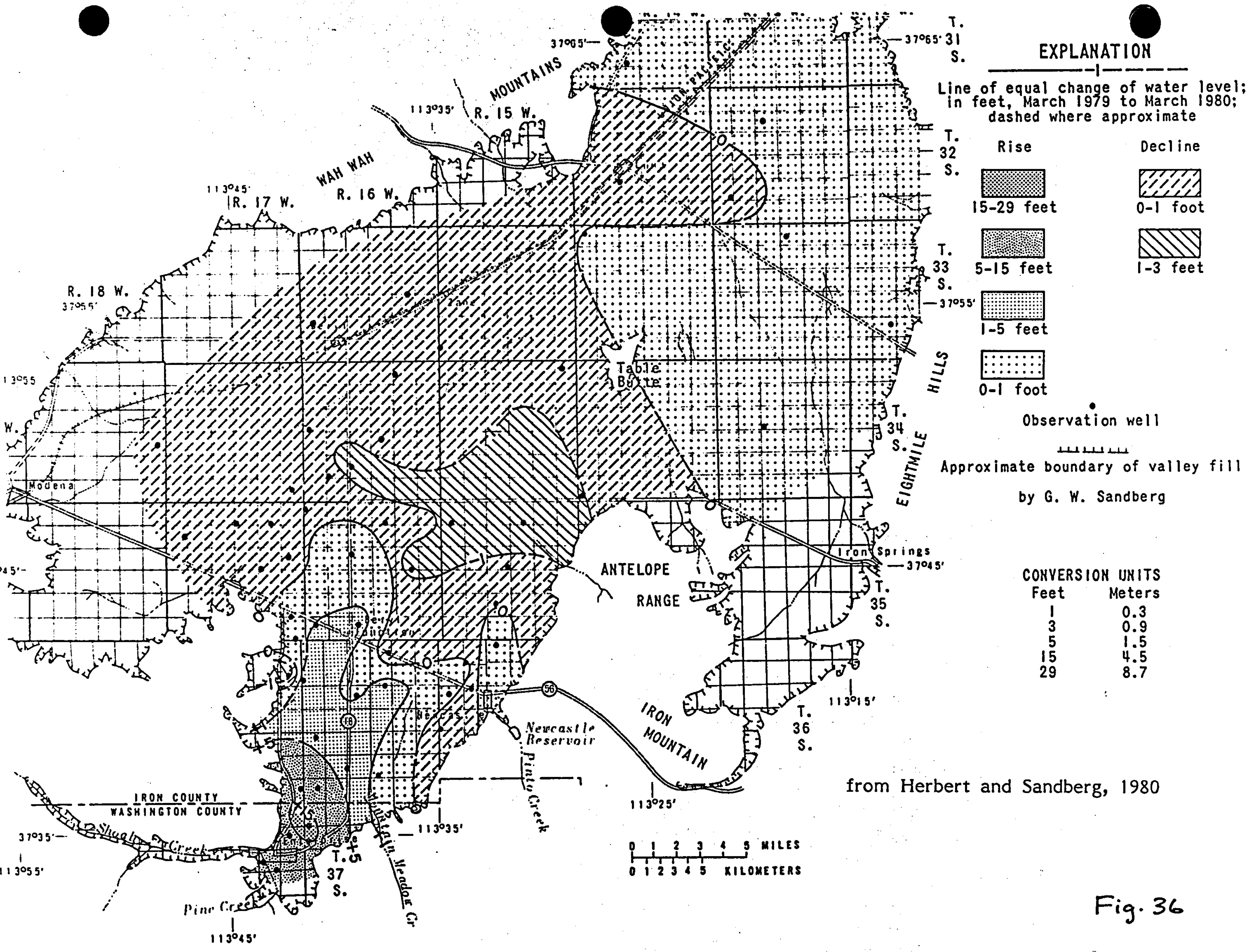


Fig. 36

—Map of the Beryl-Enterprise area, Escalante Valley, showing change of water levels from March 1979 to March 1980.

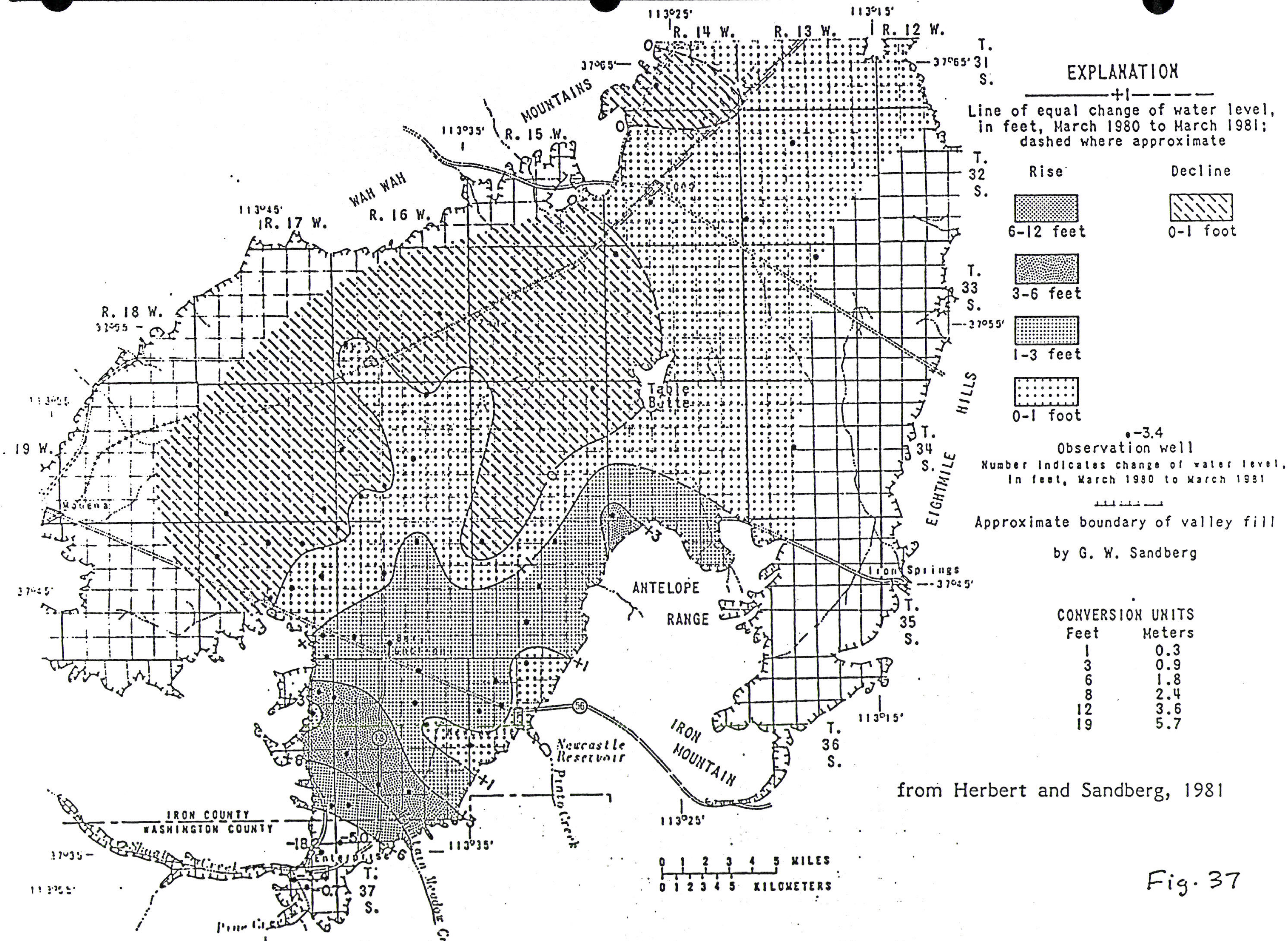
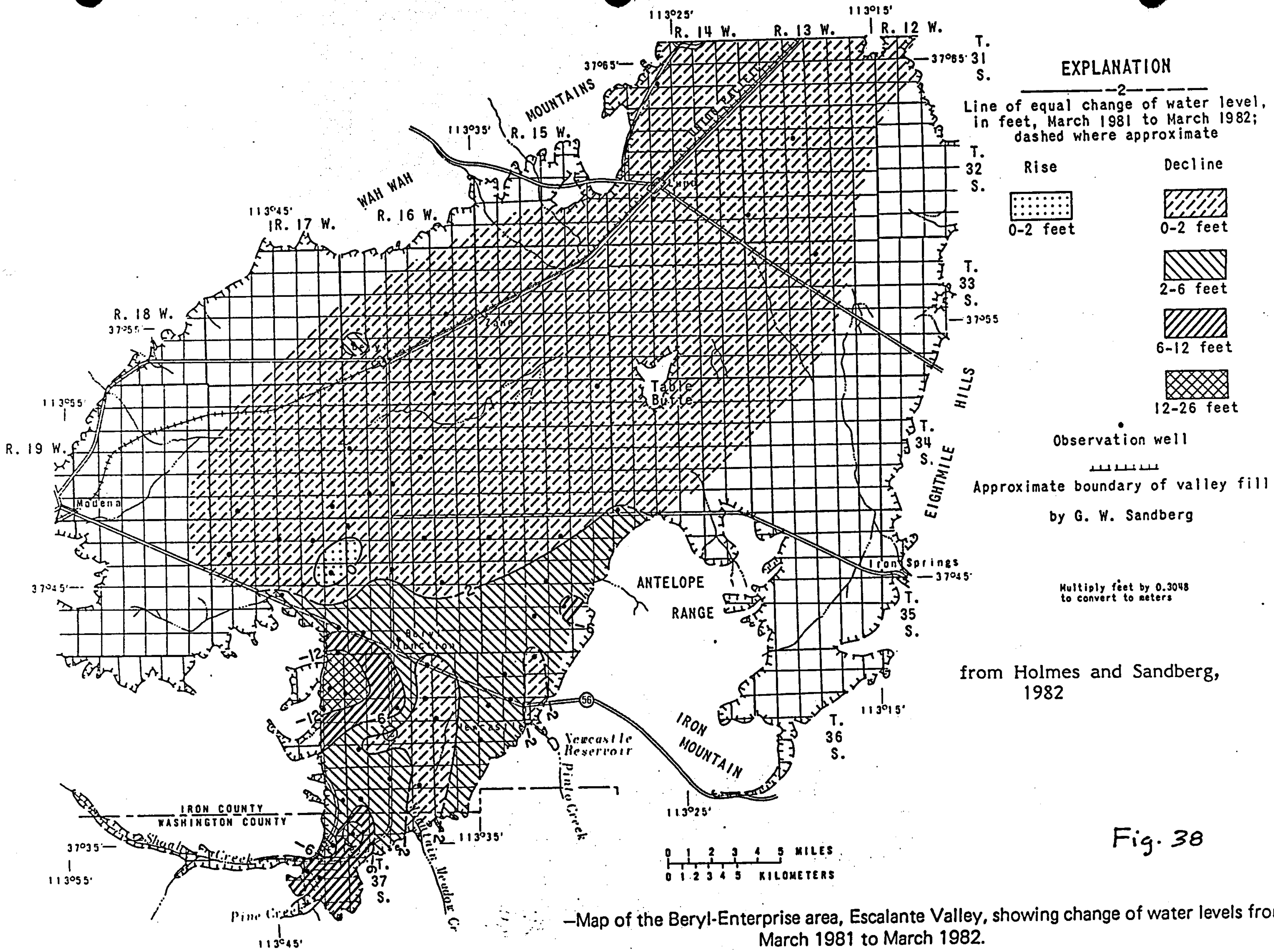


Fig. 37

—Map of the Beryl-Enterprise area, Escalante Valley, showing change of water levels from March 1980 to March 1981.



from Holmes and Sandberg, 1982

Fig. 38

—Map of the Beryl-Enterprise area, Escalante Valley, showing change of water levels from March 1981 to March 1982.

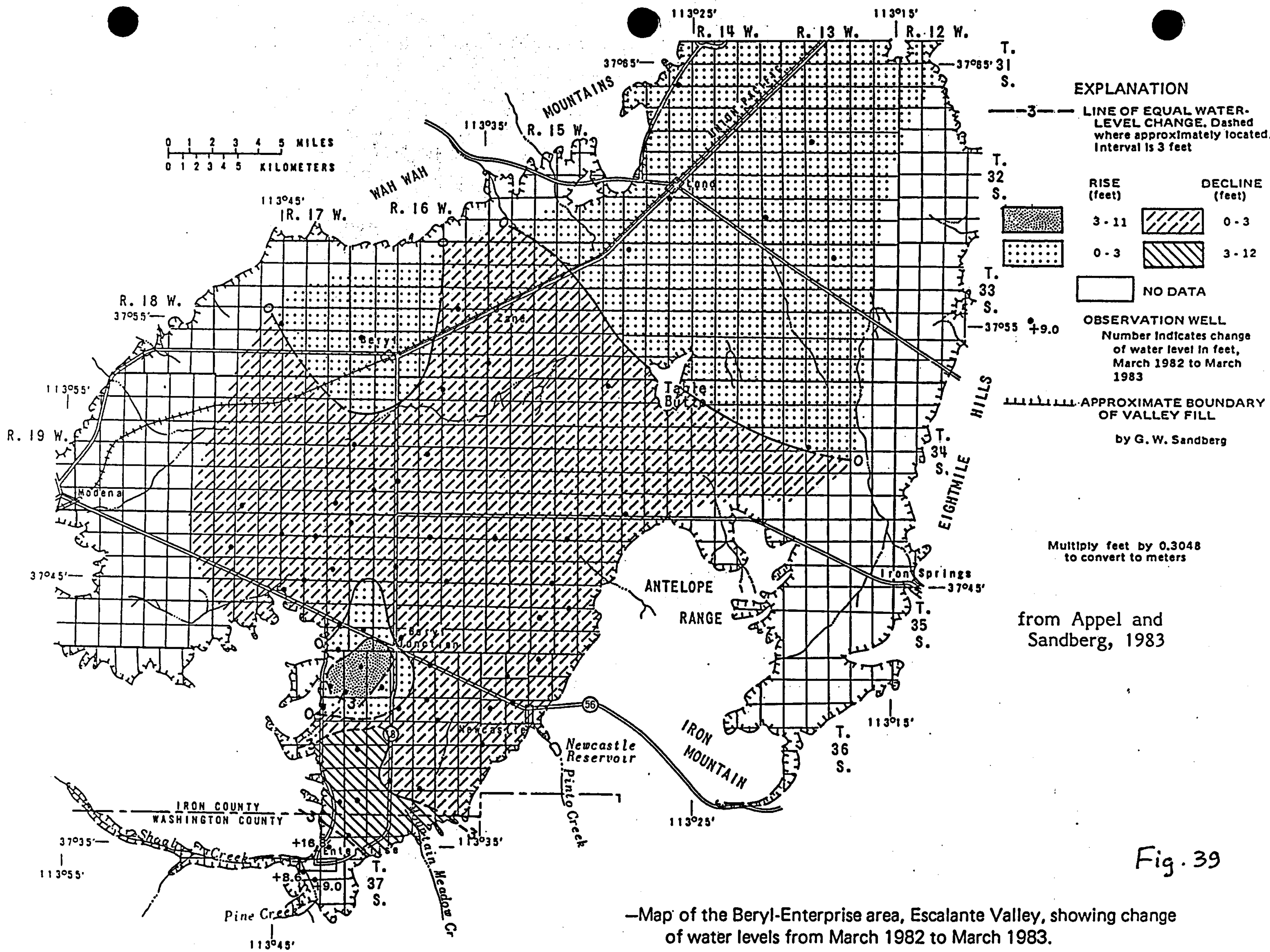
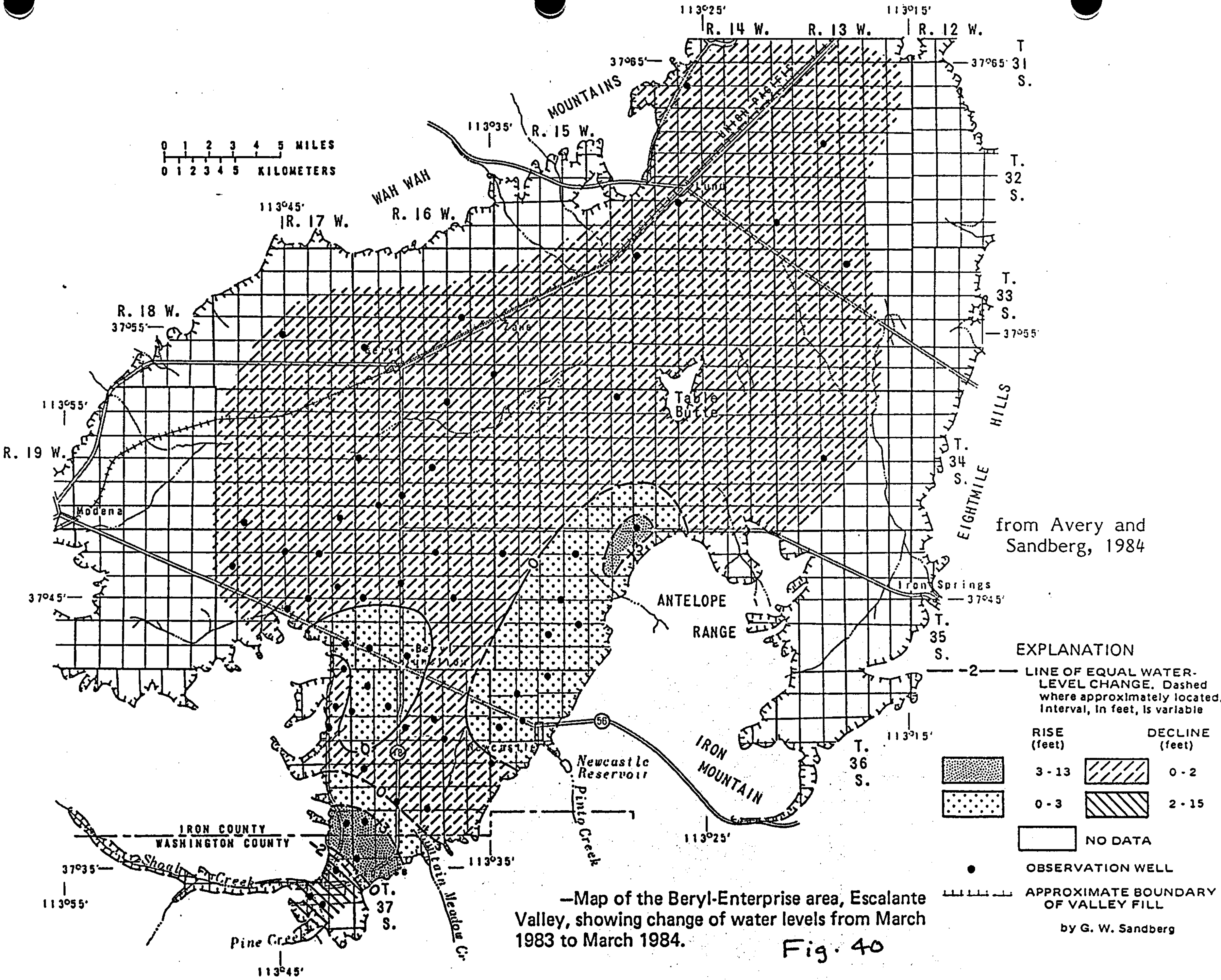


Fig. 39

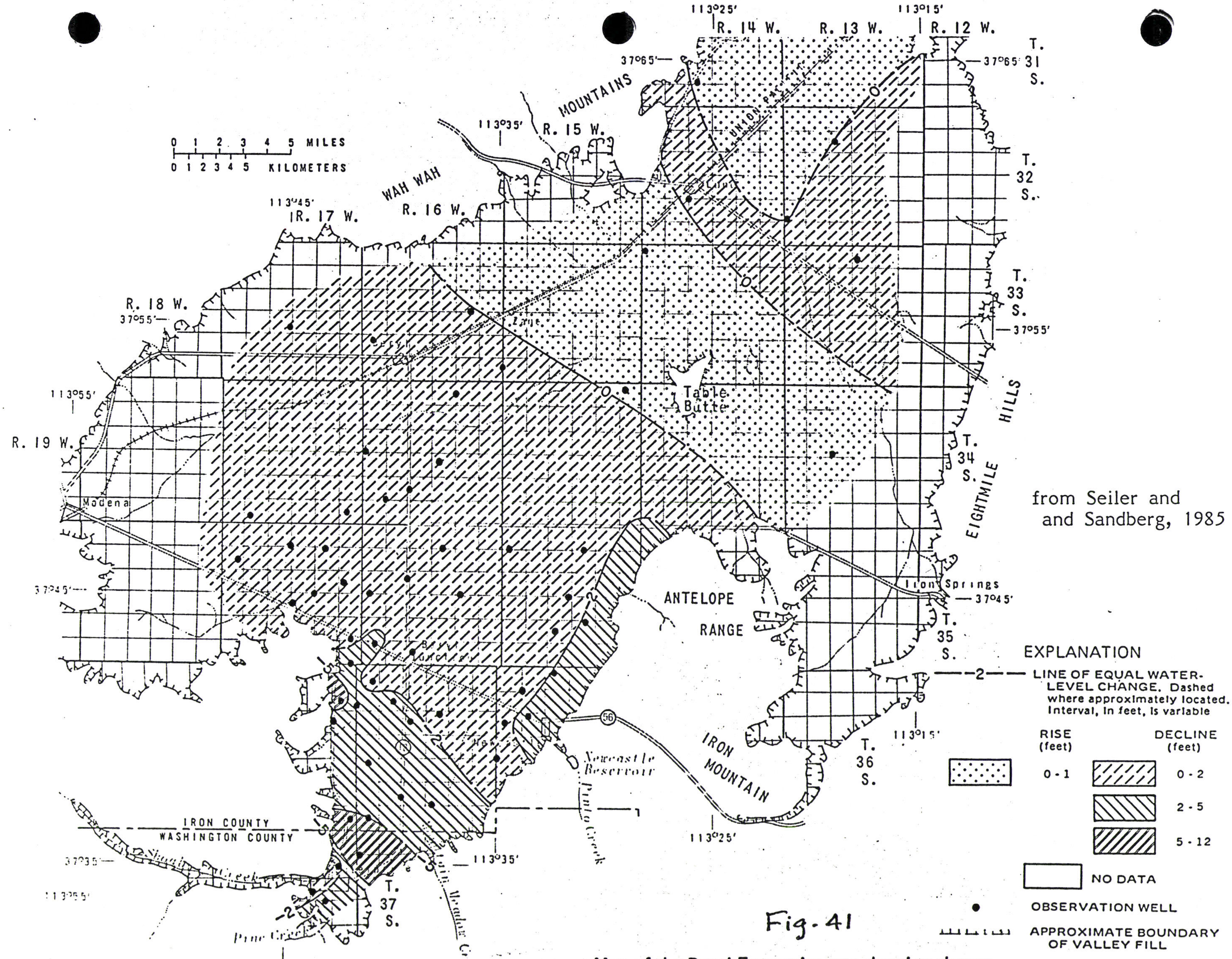
—Map of the Beryl-Enterprise area, Escalante Valley, showing change of water levels from March 1982 to March 1983.



from Avery and Sandberg, 1984

—Map of the Beryl-Enterprise area, Escalante Valley, showing change of water levels from March 1983 to March 1984.

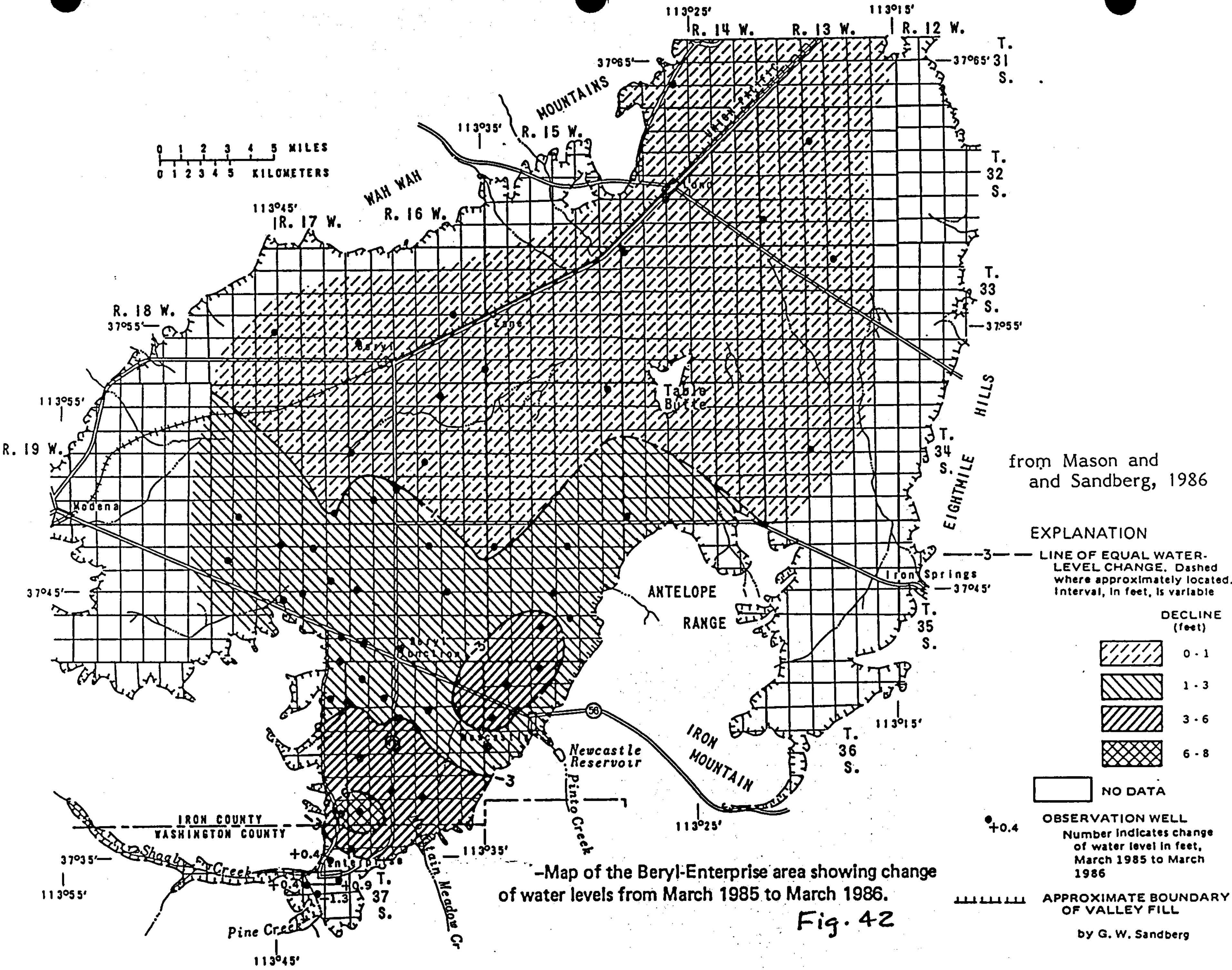
Fig. 40



from Seiler and and Sandberg, 1985

Fig. 41

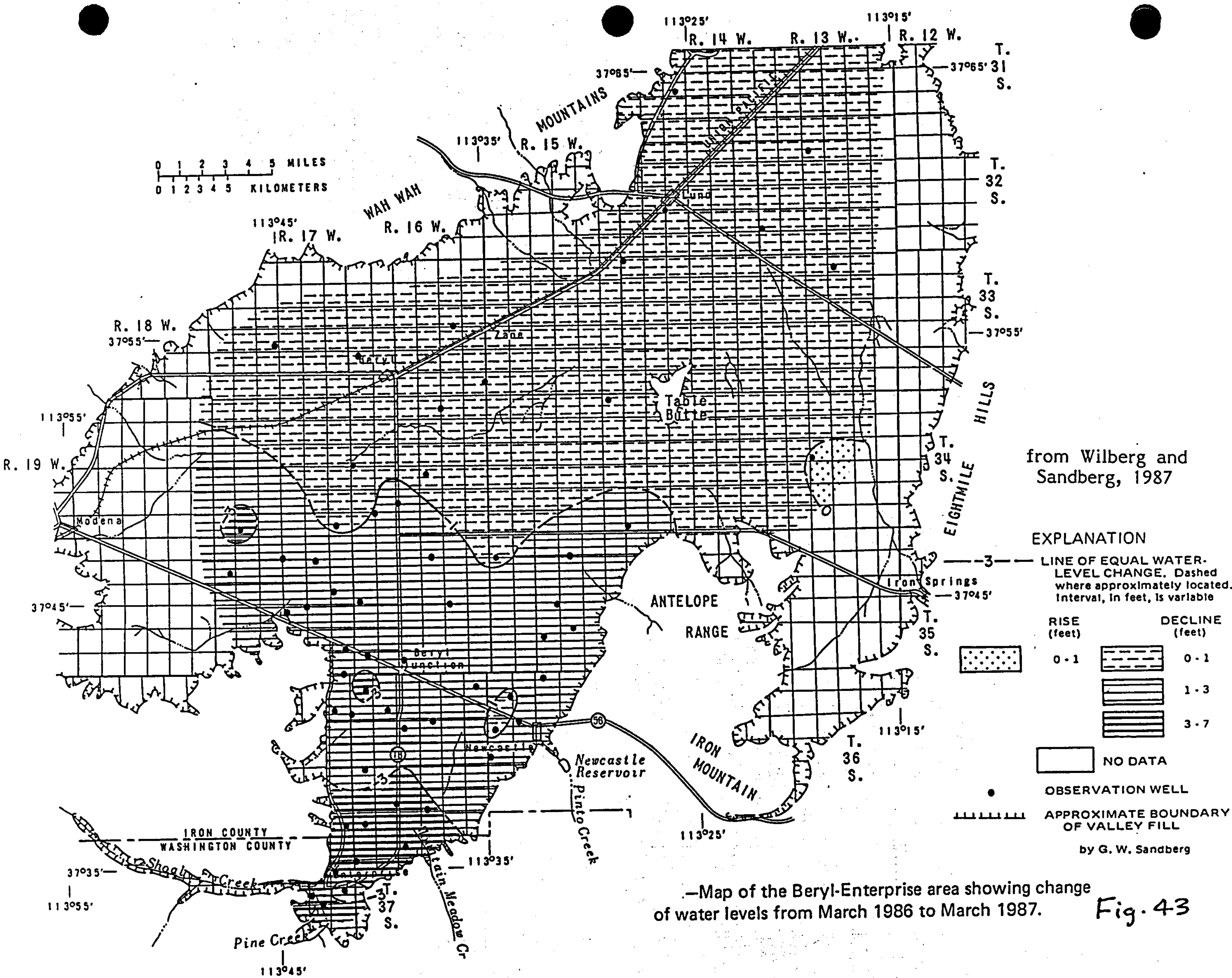
—Map of the Beryl-Enterprise area showing change of water levels from March 1984 to March 1985.



from Mason and and Sandberg, 1986

–Map of the Beryl-Enterprise area showing change of water levels from March 1985 to March 1986.

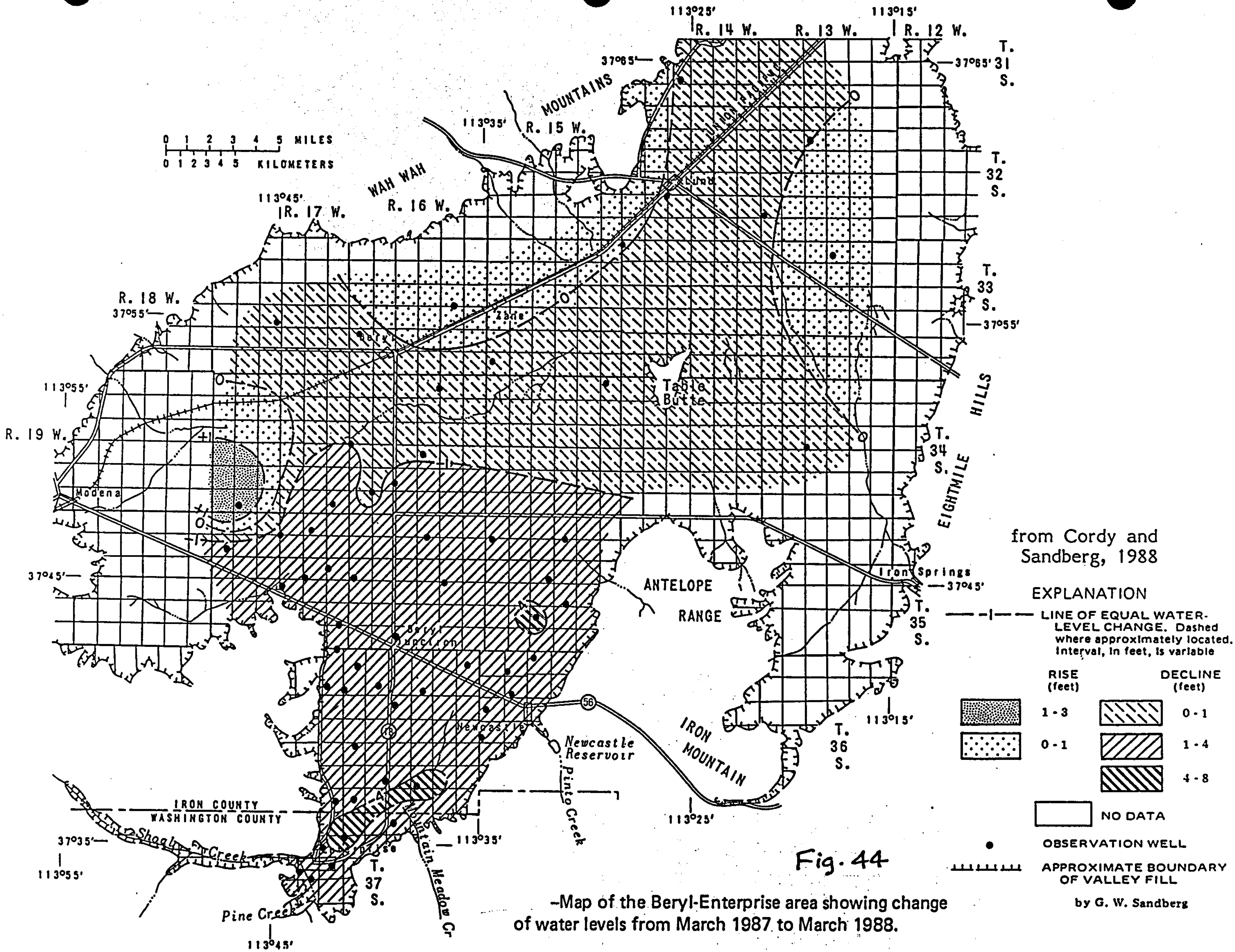
Fig. 42



from Wilberg and Sandberg, 1987

.—Map of the Beryl-Enterprise area showing change of water levels from March 1986 to March 1987.

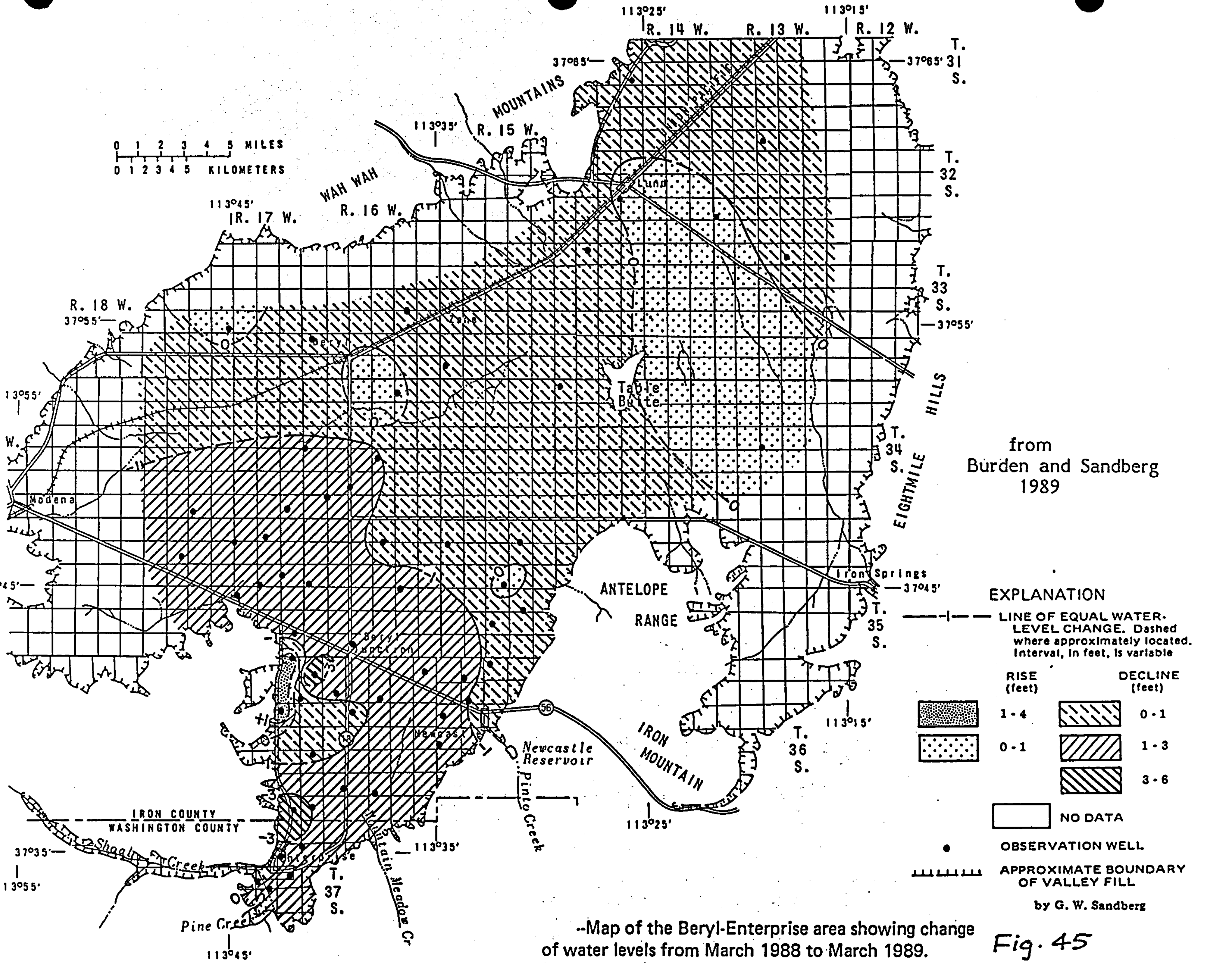
Fig. 43



from Cordy and Sandberg, 1988

Fig. 44

–Map of the Beryl-Enterprise area showing change of water levels from March 1987 to March 1988.



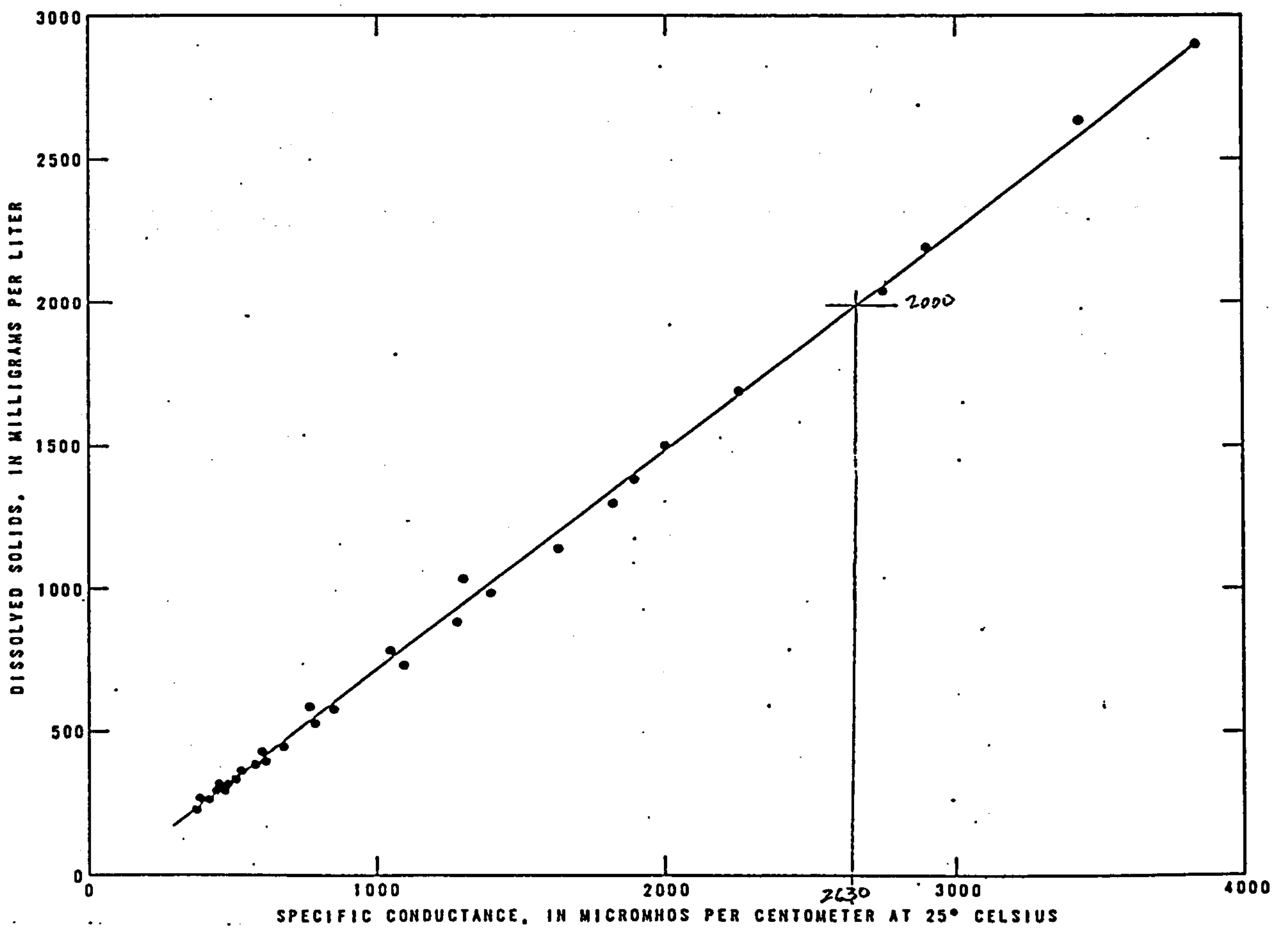
from Burden and Sandberg 1989

by G. W. Sandberg

--Map of the Beryl-Enterprise area showing change of water levels from March 1988 to March 1989.

Fig. 45

The relation between specific conductance and the concentration of dissolved solids in the water is shown by the graph. The graph indicated that the dissolved-solids concentration is about 0.75 times the specific conductance. The concentration of dissolved minerals in ground water in most of the Beryl-Enterprise area thus is calculated to be less than 1,000 mg/L (specific conductance about 1,400 μmho micromhos per centimeter at 25°C). The concentration is slightly less than 500 mg/L (specific conductance about 700 μmho) in a narrow belt mainly between Enterprise and Beryl.



Relation of specific conductance to dissolved solids in ground water. for the Beryl-Enterprise Area from Mower, R. W., 1982

Fig. 46

HYDROGEOLOGIC STUDY OF NEWCASTLE, UTAH, AREA

for

BOYD A. CHRISTENSEN

Newcastle, Utah

by

S. Bryce Montgomery, Geologist

Bountiful, Utah

March 19, 1990

HYDROGEOLOGIC STUDY OF NEWCASTLE, UTAH, AREA

INTRODUCTION: At the request of Mr. Boyd A. Christensen of Newcastle, Utah, I was asked to study the hydrologic conditions of the groundwater conditions in the Newcastle area, with specific concern as to their interconnection with other ground water in the Escalante Valley. There is a need for additional irrigation water, especially in drought years, to properly mature crops. The question for which an answer is being sought is: "Is there a reasonable means of appropriating additional ground water in the Newcastle area, without adversing existing water rights?"

In addition to my own personal work, I have made reference to the following publications and materials:

Aerial Photography Field Office, 1984, Stereo. Aerial Photos of Newcastle, Utah, area, No. 371204, 247-65 thru 247-70: U. S. Department of Agriculture, Salt Lake City, Utah;

Blackett, R. E., etal, 1989, An Assessment of the Geothermal Resources at Newcastle, Utah: Geothermal Resources Council Bulletin;

Bolke, E. L. and Sumsion, C. T., 1978, Hydrologic Reconnaissance of the Fish Springs Flat Area, Tooele, Juab, and Millard Counties, Utah: U. S. Geological Survey in cooperation with the Utah Depart. of Nat. Resures, Tech. Pub. No. 64;

Connor, J. G., etal, 1958, A Compilation of Chemical Quality Data for Ground and Surface Waters in Utah: U. S. Geological Survey in cooperation with the Utah State Engineer, Tech. Pub. No. 10;

Cook, K. L. etal, 1975, Simple Bouguer Gravity Anomaly Map of Utah: Dept. of Geol. and Geophysics, Univ. of Utah;

Christensen, B. A., 1990, Personnel communication of well data, in particular geothermal test wells on and near his property;

Feltis, R. D., 1967, Ground-water Conditons in Cedar Valley, Utah County, Utah: U. S. Geol. Survey in cooperation with Utah State Engineer, Tech. Pub. No. 16;

Gates, J. S. and Druer, S. A., 1981, Hydrologic Reconnaissance of the Southern Great Salt Lake Desert and Summary of the Hydrology of West-Central Utah: U. S. Geol. Survey in cooperation with the Utah Dept. of Nat. Resources, Tech. Pub. No. 71;

Gates, J. S., 1987, Ground Water in the Great Basin, Part of the Basin and Range Province, Western Utah: U. S. Geological Survey in Cenozoic Geology of Western Utah--Sites for Precious Metals and Hydrocarbon Accumulations, Utah Geol. Assoc. Pub. 16, 1987;

Goode, H. D., 1979, Hot Waters of Western Utah: in Rocky Mountain Association of Geologists and Utah Geological Association Symposium of Basin and Range, G. W. Newman and H. D. Goode, editors;

Hintze, L. F. compiler, 1963, Geologic Map of Southwestern Utah: Utah State Land Board;

Holmes, W. F., 1984, Ground-water Hydrology and Projected Effects of Ground-water Withdrawals in the Sevier Desert, Utah; U. S. Geol. Survey in cooperation with the Utah Dept. of Nat. Res., Tech. Pub. No. 79;

Hood, J. W., etal, 1969, Hydrologic Reconnaissance of Rush Valley, Tooele County, Utah: U. S. Geol. Survey in cooperation with Utah Dept. of Nat. Res., Tech. Pub. No. 23;

Lofgren, B. E., etal, 1954, Progress Report on Selected Ground-water Basins in Utah; Beryl-Enterprise Pumping District: in Utah State Engineer Tech. Pub. No. 9;

Lofgren, B. E., 1952, Status of Developement of Selected Ground-water Basins in Utah, Beryl-Enterprise District of Escalante Valley; in Utah State Engineer 28th Biennial Report to the Governor of Utah;

Mabey, D. R. and Budding, K. E., 1987, High-Temperature Geothermal Resources of Utah: Utah Geol. and Min. Survey, Bull. 123;

Meinzer, O. E., 1911, Ground Water in Juab, Millard, and Iron Counties, Utah: U. S. Geol. Survy, Water-Supply Paper 277;

Mower, R. W. and Cordova, R. M., 1974, Water Resources of the Milford Area, Utah, with Emphasis on Ground Water: U. S. Geological Survey in cooperation with Utah Dept. of Nat. Res., Tech. Pub. NO. 43;

Mower, R. W., 1981, Ground-water Data for the Beryl-Enterprise Area, Escalante Desert, Utah: U. S. Geol. Survey in cooperation with Utah Dept. of Nat. Res., Div. of Water Rights, Utah Hydrologic-Data Report No. 35;

Mower, R. W., 1982, Hydrology of the Beryl-Enterprise Area, Escalante Desert, Utah, with Emphasis on Ground Water: U. S. Geol. Survey in cooperation with Utah Dept. Nat. Res., Div. of Water Rights, Tech. Pub. No. 73;

Rush, F. E., 1983, Reconnaissance of the Hydrothermal Resources of Utah: U. S. Geol. Survey Prof. Paper 1044-H, p. H1-H49;

Sandberg, G. W., etal, 1964 -1989, Ground-water Conditons in Utah, Springs of 1964-1989, Escalante Valley, Beryl-Enterprise District: U. S. Geological Survey in cooperation with the Utah Water and Power Board and Utah Board of Water Resources, Developing a State Water Plan, Cooperative Investigations Nos. 2 thru 29;

Sandberg, G. W., 1966, Ground-water Resources of Selected Basins in Southwestern Utah; U. S. Geol. Survey in cooperation with the Utah State Engineer, Utah State Engineer Tech. Pub. No. 13;

Sandberg, G. W., 1966, Ground-water Data Beaver, Escalante Cedar City, and Parowan Valleys, parts of Washington, Iron, Beaver, and Millard Counties, Utah: U. S. Geol. Survey in cooperation with the Utah State Engineer, Basic-Data Report No. 6;

Thomas, H. E., etal, 1952, Status of Development of Selected Ground -water Basins in Utah; Beryl-Enterprise District of Escalante Valley, Iron and Washington Counties, by B. E. Lofgren: U. S. Geol. Survey in cooperation with the Utah State Engineer, Tech. Pub. No. 7.

HYDROGEOLOGY, REGIONAL AND LOCAL: The Newcastle area is the southeastern part of the Escalante Valley, adjacent to the northwestern side of the Antelope Mountain Range, and immediately north of the Pine Valley Mountains. The Escalante Valley is one of the eastern basins of the larger Basin and Range Province.

Faulting and fracturing that have experienced movements on them since Lake Bonneville time, have cut both the volcanic and sedimentary rocks and the Quaternary age alluvium. Study of stereo-pairs of infrared aerial photographs of the area show late-age faulting near the mountain front and within the valley a few miles west and northwest of Newcastle, as shown on the attached hydrogeologic map of the Newcastle Quadrangle (Figure 1); such movement displaces and offsets strata that convey and store ground water. Such a fault exists between the cold water well in the NW/4 NW/4 Sec. 19 and the hot-water wells within the NW/4 NW/4 Sec. 20, T36S, R15W, within two miles southwest of Newcastle.

Where ground water exists under artesian pressures and the overlying, confining strata are interupted by faulting, some of the confined water rises along the fault plane and flows into permeable strata having lesser internal pressures. Such is the situation of the Newcastle geothermal area, centered immediately southwest of Newcastle, in the NW/4 Section 20. The geothermal waters have originated, initially, from atmospheric precipitation and infiltration on the Pine Valley and Antelope Mountain Ranges to the south of Newcastle. As shown on the attached portion of the geologic map of Washington County by Cook,1960, (Figure 2), there are prominent faults and fractures within the underlying bedrock from the highest elevations of the Pine Valley Mountains to the faulted mountain front immediately southeast of the geothermal center. These serve as conveyance channels for the ground water which by gravity, moves downward, deep into the earth's rock formations. Some of it has come in contact with heated rocks, of a likely magmatic source, and then under the hydrodynamic head developed from its flow from the mountains has risen along conduits opened by movement along the bounding valley fault. The circulating ground water has dissolved and acquired minerals through its movement, as evidenced by water analysis from the geothermal wells. The higher content of characteristic minerals of the geothermal system are silica, sodium, and sulfate, along with calcium carbonate (lime). The attached map by Mower, 1982, (Figure 47) of the general quality of ground water, as indicated by specific conductance, shows the area of highest mineral content immediately west of Newcastle and another local area just south of Antelope Road, seven miles to the north-northeast. Figure 46 of this report shows the relationship of specific conductance to dissolved solids in ground water. The dissolved-solids concentration is about 0.75 times the specific conductance.

Although the geothermal waters at Newcastle are mineralized, their total content is not high enough to prevent their use for irrigation. The Christensen well located in the SW/4 NE/4 NW/4 Sec. 20, T36S, R15W, had a reported total dissolved mineral content of approximately 1200 mg/l, based on the electrical specific conductance of 1600 micromhos/centimeter. The sodium content was reported as 270 mg/l, the chlorides 52 mg/l, the sulfates 580 mg/l and silica dissolved 99 mg/l.

A study of the drill hole logs at the geothermal center show an abundance of tufa (calcium carbonate) deposited within the alluvial sediments, between a depth of 6 to 280 feet, evidencing the precipitation of the minerals from the geothermal waters as their pressure is reduced upon flowage into permeable gravel and sand strata or discharge to the ancient land surface.

As shown on the hydrogeologic map (Figure 1), and Mowers map, 1982, (Figure 4), the contouring of well water temperatures evidences that the groundwater movement from the geothermal center is to the southwest, west, northwest and north-northeast. This is influenced by the north-trending, late-age faulting along with the regional slope of the Escalante Valley, and the permeable sand and gravel deposition out of Pinto Creek canyon, which is northward. See attached map of Mower, 1982, (Figure 48), of the distribution of sand and coarser materials in the Beryl-Enterprise area. Since the present-day Pinto Creek channel is running close to and parallel to the mountain front, rather than westward into the main valley, it appears to have also been influenced by recurrent, downward movement on the west side of the fault that bounds the east side of the valley.

A regional gravity survey by Cook, etal (1975), see Figure 3, shows the Newcastle area and north-northeastward to the east-west, Antelope crossroad through Escalante Valley from Iron Springs, to be an abrupt depositional and down-faulted, subsurface depression. This map supports the faulting previously described, and further indicates the reason for north-northeasterly flow of ground water from the geothermal center and adjacent area.

The attached map (Figure 5) of residual sodium carbonate of ground water by Mower (1982) further outlines the area of the geothermal center and an extension northward to the west side of Table Butte as being highest in sodium carbonate content.

The contours of equal sulfate content in the ground water shown on the hydrogeologic map indicates the outward groundwater flow from the rising geothermal waters.

Thus, the well water temperature contours shown on Figures 1 and 4, along with the geologic map of Figure 1 showing the down-dropped faulted area (graben), along with the gravity contours shown on Figures 1 and 3, the sodium carbonate content contour map of Figure 5, the specific conductance (general mineral quality ground water map) of Figure 47, and the modified potentiometric surface contour map of the Spring of 1978 (Figure 6), all compliment one another to show that the ground water in the geothermal center and adjacent area within the graben in the east side of Escalante Valley is a distinct and local hydrologic unit within the larger Escalante Basin.

The extensive studies made by others and more particular by Mower (1982), show that the increased pumping of the groundwater resource over the years has caused a general decline in the groundwater levels (potentiometric surface) of Escalante Valley. See the many attached maps from 1937 to the Spring of 1989 (Figures 8 thru 45), showing changes in the potentiometric groundwater surface related to well pumping and annual recharge. It can be noted that some years such as March 1968 - March 1969, March 1970 - March 1971, March 1973 - March 1974, and March 1977 - March 1978, show local declines in the Newcastle area. There has been an obvious groundwater low developed by the regional decline in water level in the area at and immediately south of Beryl Junction, centered about 6 miles west of Newcastle. Upon examining Mowers (1982) map (Figure 8), the potentiometric surface and general direction of ground-water movement, Spring of 1937 to that of the map of Spring of 1978 (Figure 9), it is obvious that there was no well control used within a distance of 4 miles to Newcastle, in preparing the 1937 map. However, the 1978 map did utilize data from some of the later drilled wells within a mile northwest and northeast and two miles southwest of Newcastle. I have utilized the same measured water levels in the Spring of 1978 and recontoured the potentiometric surface of the middle and eastern part of Escalante Valley (see Figure 6) and find that the contouring immediately north of Newcastle can be further extended to show a local sink where ground water is locally moving downward into underlying, fractured bedrock beneath the alluvial fill of the valley. If deep, heated, ground water can circulate upwards under a differential head through fault openings, to near the surface, it is reasonable and correct to recognize the potential for downward loss of ground water through a local fracture system into the fractured bedrock beneath the valley under a differential head.

As shown on the attached hydrogeologic map (Figure 1), prominent fracture linements extend from the mountains south of Newcastle, directly into the geothermal center of rising ground water. Likely, additional fractures also exist in the area, undetected. At the south and north edge of Newcastle Town are wells that reportedly intercepted bedrock at relatively shallow depths. These are as follows:

> The George Beacham well, drilled to a total depth of 350 feet, within the NW/ NE/4 NE/4 Sec. 20, T36S, R15W, which reported "soft tuff, tuff and altered volcanics with clay streaks" from 140-350 feet, and a water temperature of 180°F;
>
> The Malin Gardner well was drilled to a total depth of 405 feet, within the SW/4 NW/4 Sec. 16, T36S, R15W, which reported "rhyolite with some trace of clay" from 72-405 feet", and a water temperature of 110°.

Farther north another 1 1/4 miles a U. S. SteelCorporation well was drilled to total depth of 590 feet, within the NE/4 NE/4 NW/4 Sec 9, T36S, R15W, with bedrock reported having "all same color", from 580-589 feet.

Northwest 6½ miles from Newcastle Town, the Dallin Williams well was drilled in 1980 to a total depth of 920 feet, within the SW/4 NW/4 Sec. 23, T35S, R16W, with reported bedrock from 902-920 feet. The driller also reported the loss of all drill cutting returns while drilling the bedrock, evidencing that permeable fractures are present within it. Furthermore, the static water level within the alluvial aquifer consisting of reported "fine sandy gravel with clay streaks," exposed in open hole below the 10-inch diameter casing set at 400 feet depth, was 67 feet below land surface on November 24, 1980. Thus, to a degree, some ground water is being lost from the main Escalante Valley alluvial aquifer to the underlying bedrock aquifer, under a head loss.

Several studies conducted by U. S. Geological Survey personnel in cooperation with the Utah Division of Water Rights (State Engineer's Office), Department of Natural Resources, have shown that there is interbasin movement of deep ground water within underlying bedrock, in the Great Basin area of western Utah. These accounts are within previously stated references. Attached to this report is a map (Figure 7) showing the deep, bedrock, regional, interbasin groundwater flow in the western part of Utah, with emphasis on the Newcastle area.

The groundwater contours shown on the attached hydrogeologic map (Figure 1) and the other potentiometric surface maps (Figures 6, 8-9, 12-13, 15, 17-18, 20, and 28) are actually averages of the groundwater potentiometric surface, since the wells used for control have perforations from approximately 40-700 feet depth within different alluvial aquifers, which have variable heads. The extending tongue of higher ground water immediately northwest of Newcastle, within the generally depressed groundwater surface, southwest and north of Newcastle, is apparently related to the concentrated recharge of the shallower, alluvial aquifer from the fractured bedrock in the mountains, including discharge from the geothermal aquifer. The natural springs located in the NE/4 Section 20 and SW/4 Section 16 also evidence this concentrated recharge of the shallower aquifer, as they represent some spillage of the recharge from the mountains.

The apparent gap in the groundwater surface, as shown by the potentiometric surface contours, three miles northwest of Newcastle near the alignment of Highway 56 is supported by the general decline of the groundwater surface in the area of as much as 50 feet, over the years of increased pumping in the Escalante Valley. Thus, an appreciable part of the ground water from the shallower, alluvial aquifers in the Newcastle area has moved towards the central part of the Escalante Basin, at the same time part of the ground water has apparently moved downward into fractures of underlying bedrock within the graben area, along the west and northwest side of the mountain front near Newcastle. This downward loss of ground water from the alluvial aquifers to the underlying, fractured bedrock aquifer prevents the more complete and beneficial use of the total groundwater resource.

CONCLUSIONS AND RECOMMENDATIONS: Referring back to the introduction and reason for this study, as to the interconnection of the ground water in the Newcastle area with that in the rest of the Escalante Valley and how this may support the further appropriation and diversion of well well water for irrigation in the Newcastle area, this study provides evidence for the need to develope the deeper aquifers.

Ground water that presently leaks from the alluvial aquifers into zones of permeable bedrock beneath, and then moves northward out of the area to receiving basins at lower elevations, miles away, of very saline to briny ground water, is lost to beneficial use. Thus, to more fully utilize the groundwater resource of the Newcastle area, it is recommended that the deeper aquifer below 700 feet and the underlying bedrock aquifer be permitted for the further drilling of wells and production of needed ground water. The log of the Union geothermal test well drilled to a total depth of 3015 feet in the SW/4 NW/4 Sec. 20, T36S, R15W, showed a 100-foot section of conglomerate from 920-1020 feet which is a potential aquifer.

New, deep wells to produce additional ground water from the lower alluvial and underlying bedrock aquifers would best be located in areas of known or inferred faulting, within the area of depressed potentiometric groundwater surface. Such recommended locations are as follows:

(1) SW/4 SW/4 SW/4 Sec. 18, T36S, R15W;

(2) NW/4 SE/4 NW/4 Sec. 19, T36S, R15W;

(3) NW/4 NW/4 NW/4 Sec. 16, T36S, R15W;

(4) N/2 SW/4 Sec. 17, T36S, R15W;

(5) NE/4 NE/4 Sec. 17, T36S, R15W;

(6) NE/4 SW/4 Sec. 5, T36S, R15W;

(7) W/2 E/2 NE/4 Sec. 5, T36S, R15W;

(8) W/2 W/2 E/2 Sec. 32, T35S, R15W; and
(9) W/2 SW/4 Sec. 3, T36S, R15W.

The wells should be drilled to a total depth of at least 1000 feet and perforations or screens be placed below 700 feet. The lower ends of the holes below 700 feet would best be drilled without the use of bentonitic drilling mud, in order to prevent the plugging of the aquifers by the drilling fluid, which is under both a hydrostatic head and applied circulation, pump pressure. When test pumping is conducted on the completed wells, water level measurements should be conducted on surrounding wells to observe any drawdown affect. This test pumping would best be done during the non-pumping season for irrigation. Since water appropriations and resultant water rights are granted in order of priority, any measureable adverse affects on surrounding wells would be detected and the pumping of the new wells regulated according to any proven adverse affects.

Respectfully submitted,

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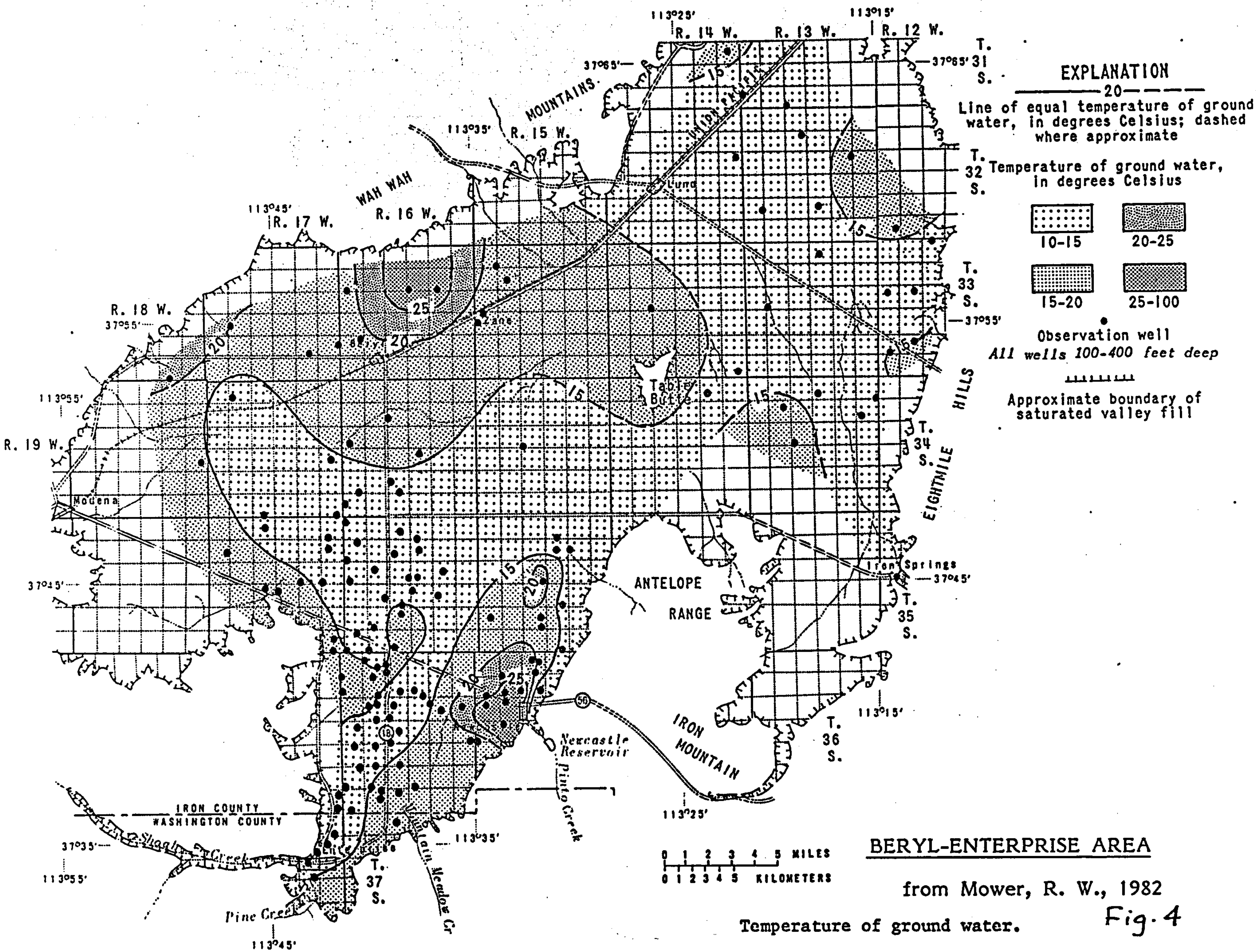
Attachments: Figures 1-48

March 19, 1990

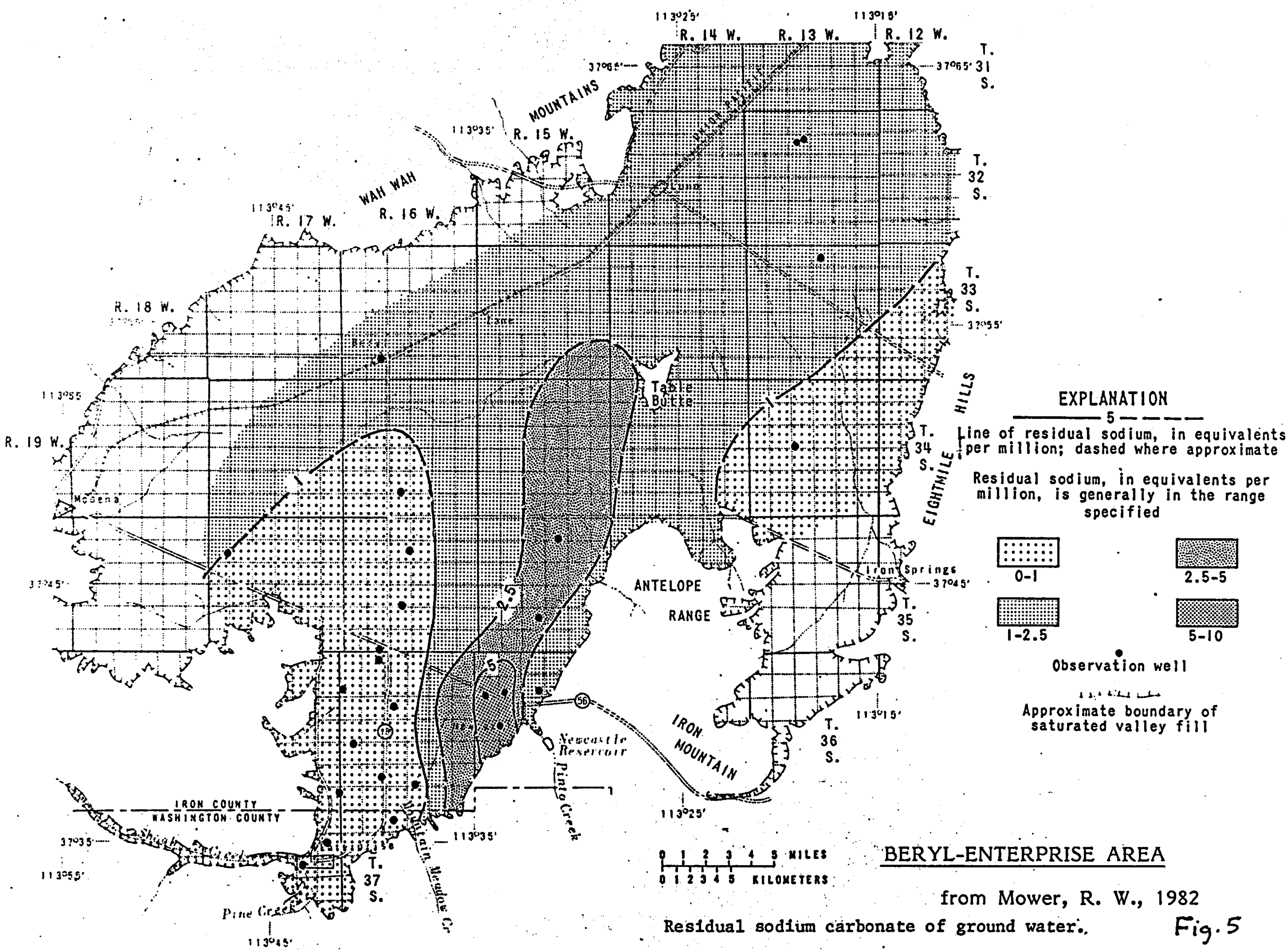


BERYL-ENTERPRISE AREA

from Mower, R. W., 1982

Temperature of ground water.

Fig. 4

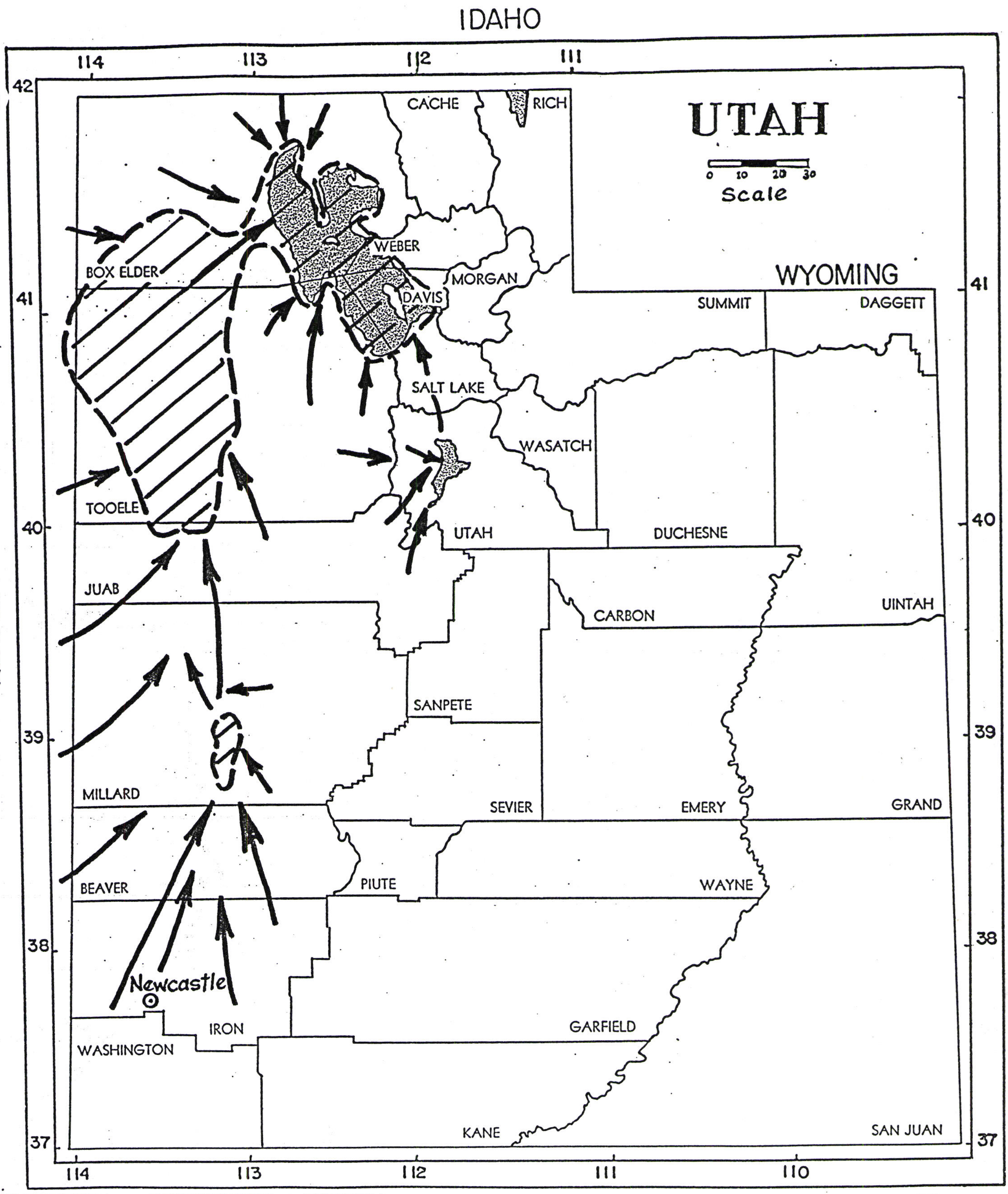


BERYL-ENTERPRISE AREA

from Mower, R. W., 1982

Residual sodium carbonate of ground water.

Fig. 5



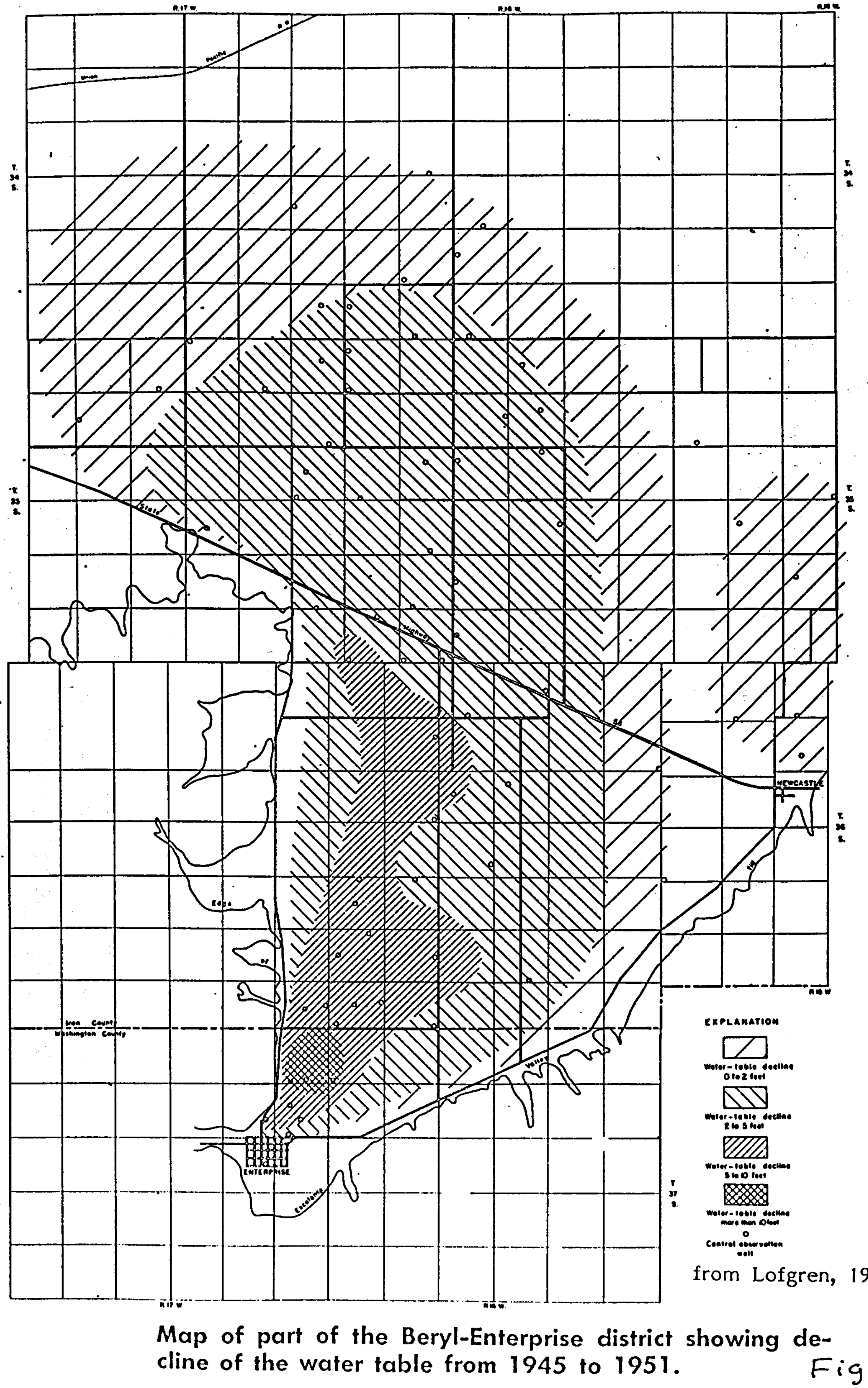
DEEP, BEDROCK, REGIONAL, INTERBASIN GROUNDWATER FLOW IN WESTERN UTAH

Modified from Gates, J. S. (1987) S. Bryce Montgomery, Geologist 1990

Legend: Deep, groundwater flow

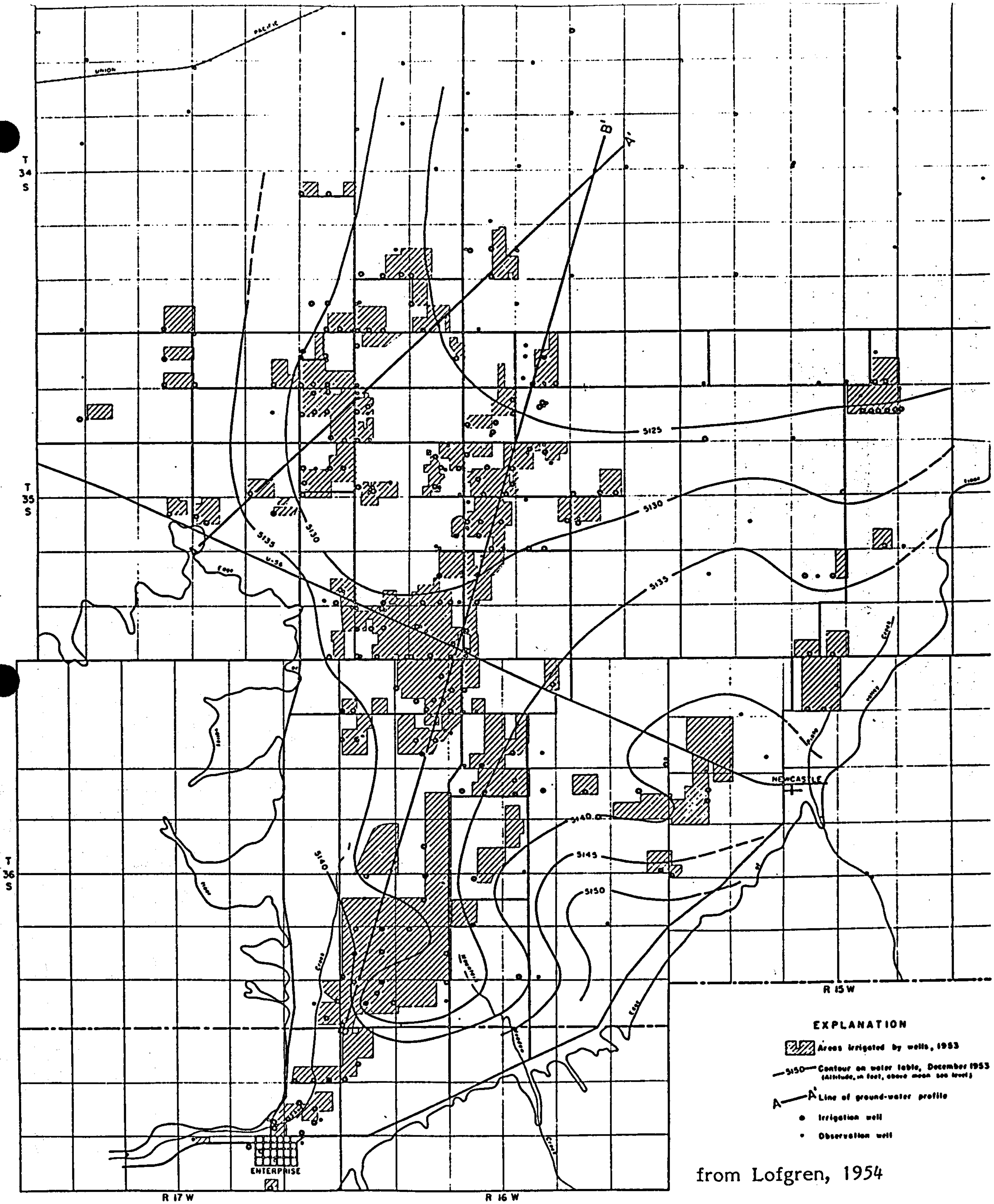
Receiving basins containing very saline to briny ground water

Fig. 7



from Lofgren, 1952

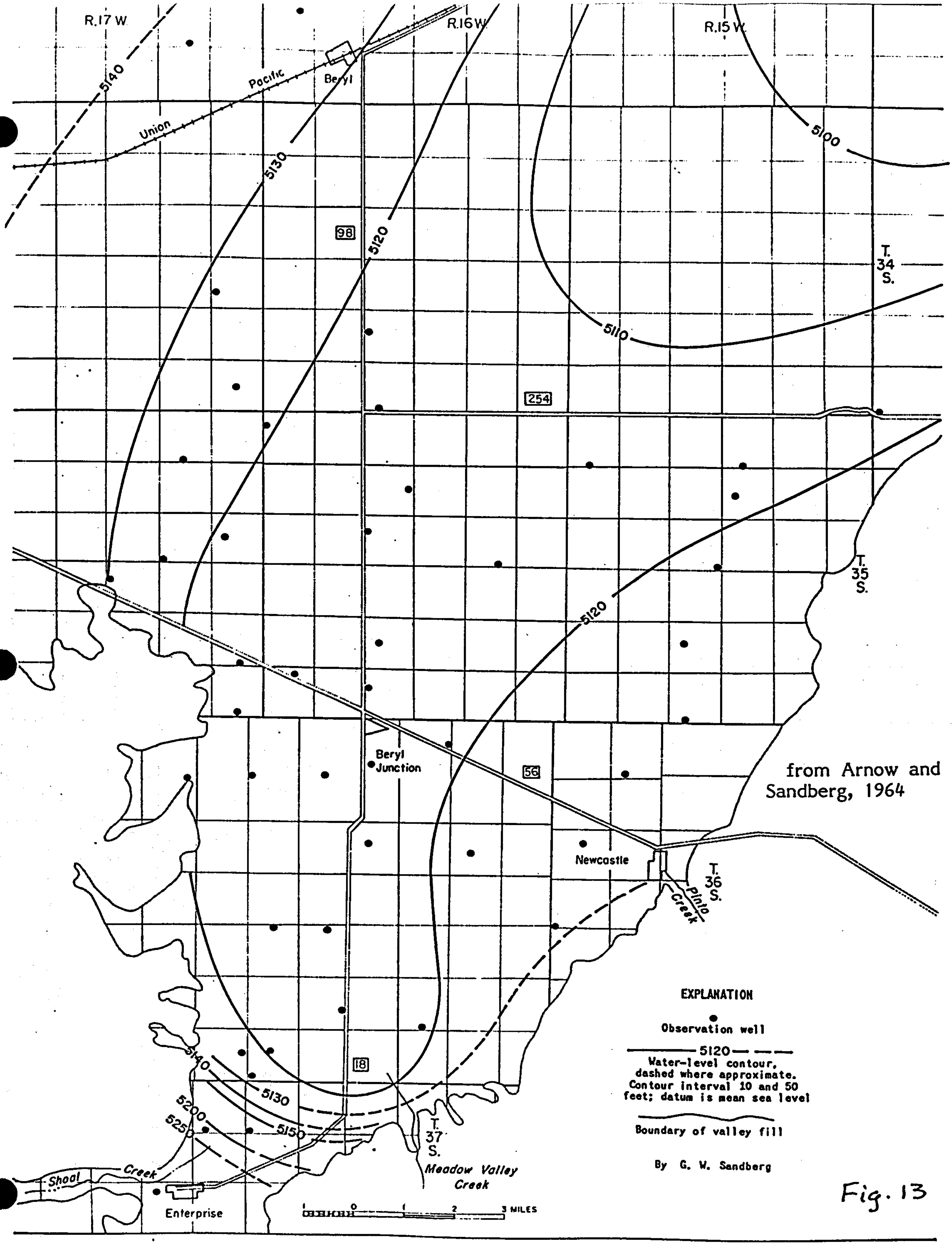
Map of part of the Beryl-Enterprise district showing decline of the water table from 1945 to 1951. Fig. 11



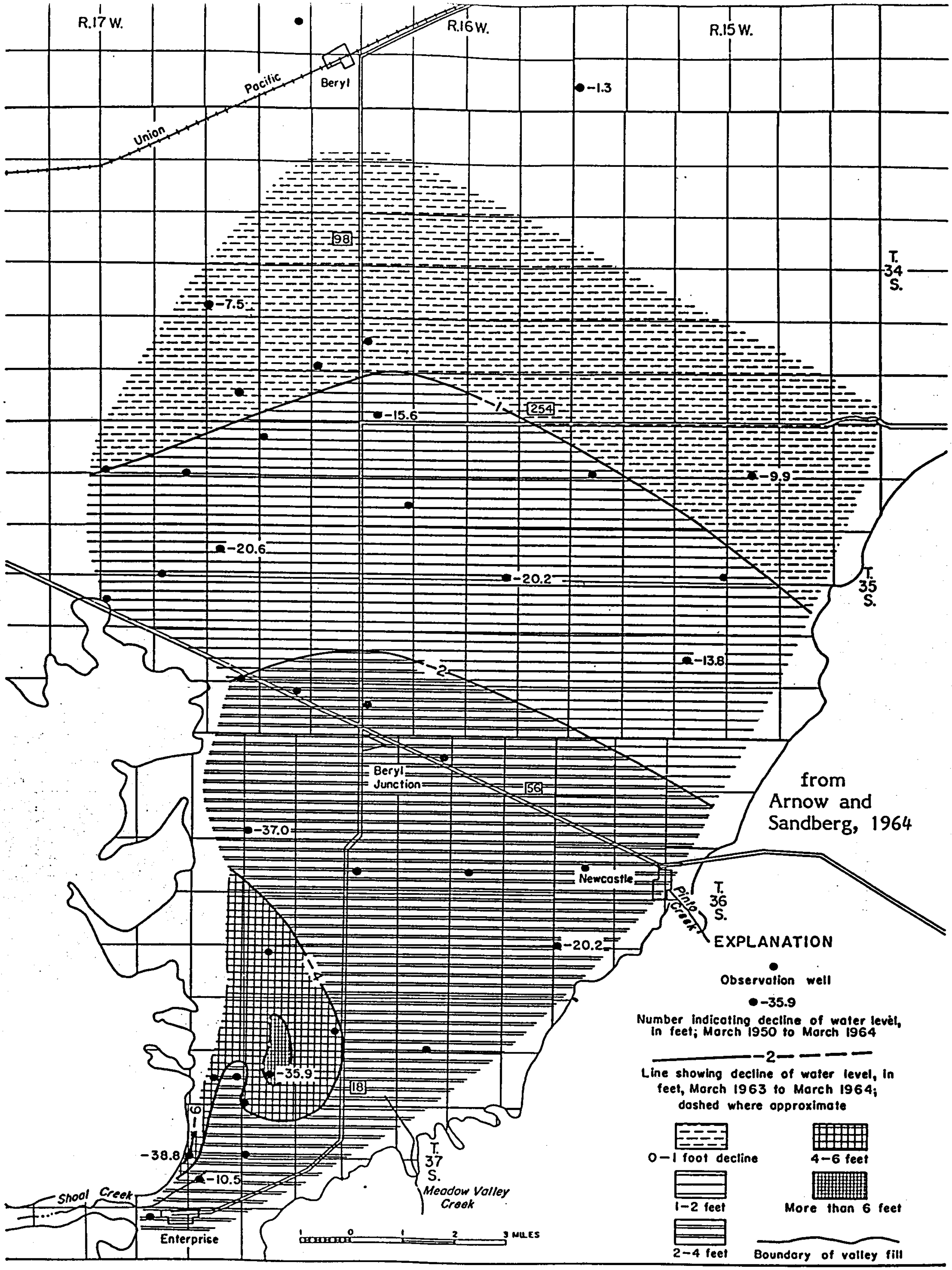
from Lofgren, 1954

Map of Beryl-Enterprise district showing the location of irrigation wells, areas irrigated by wells, and water-table contours for December 1953.

Fig. 12

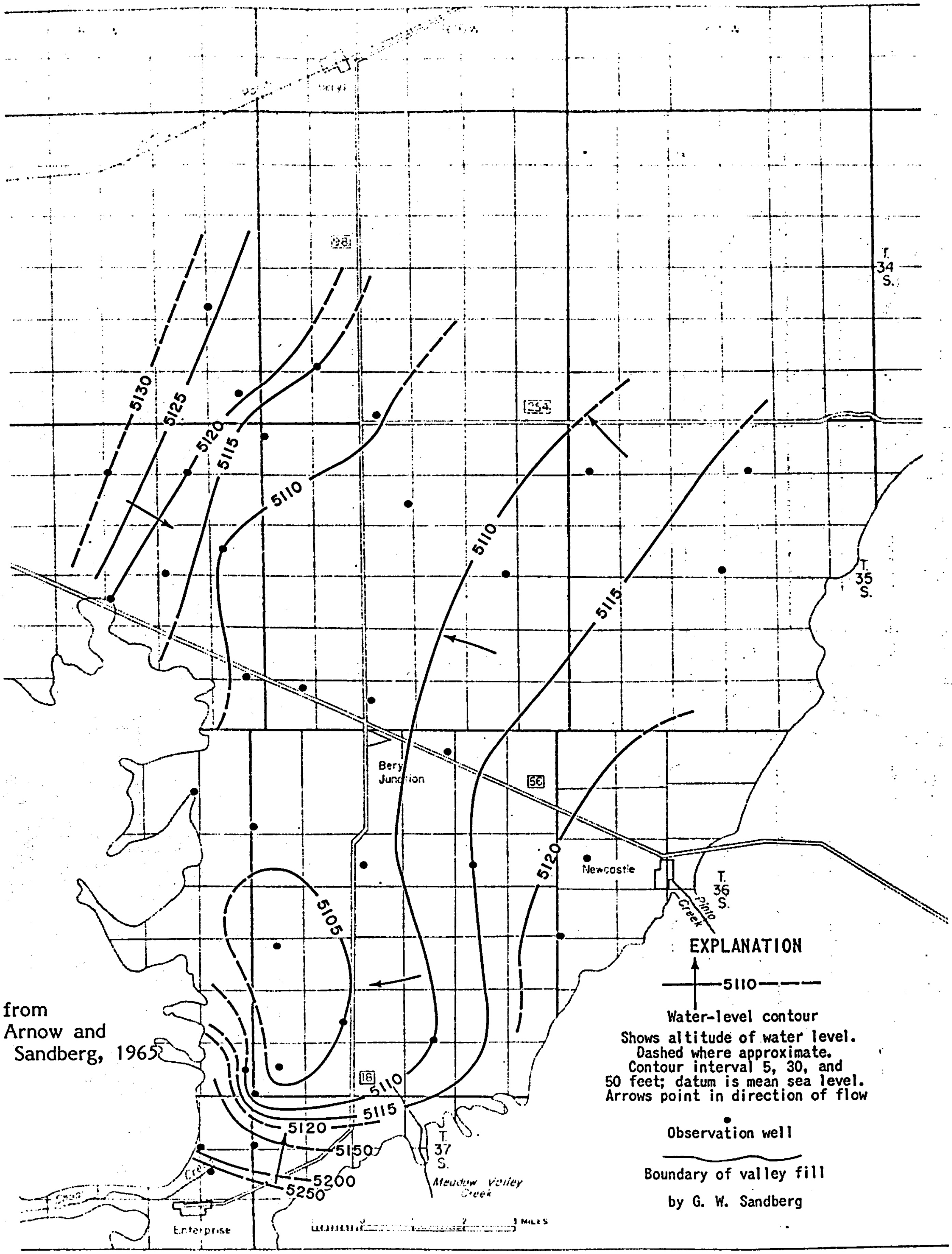


Map of the Beryl-Enterprise district, Escalante Valley, showing water-level contours, March 1962.



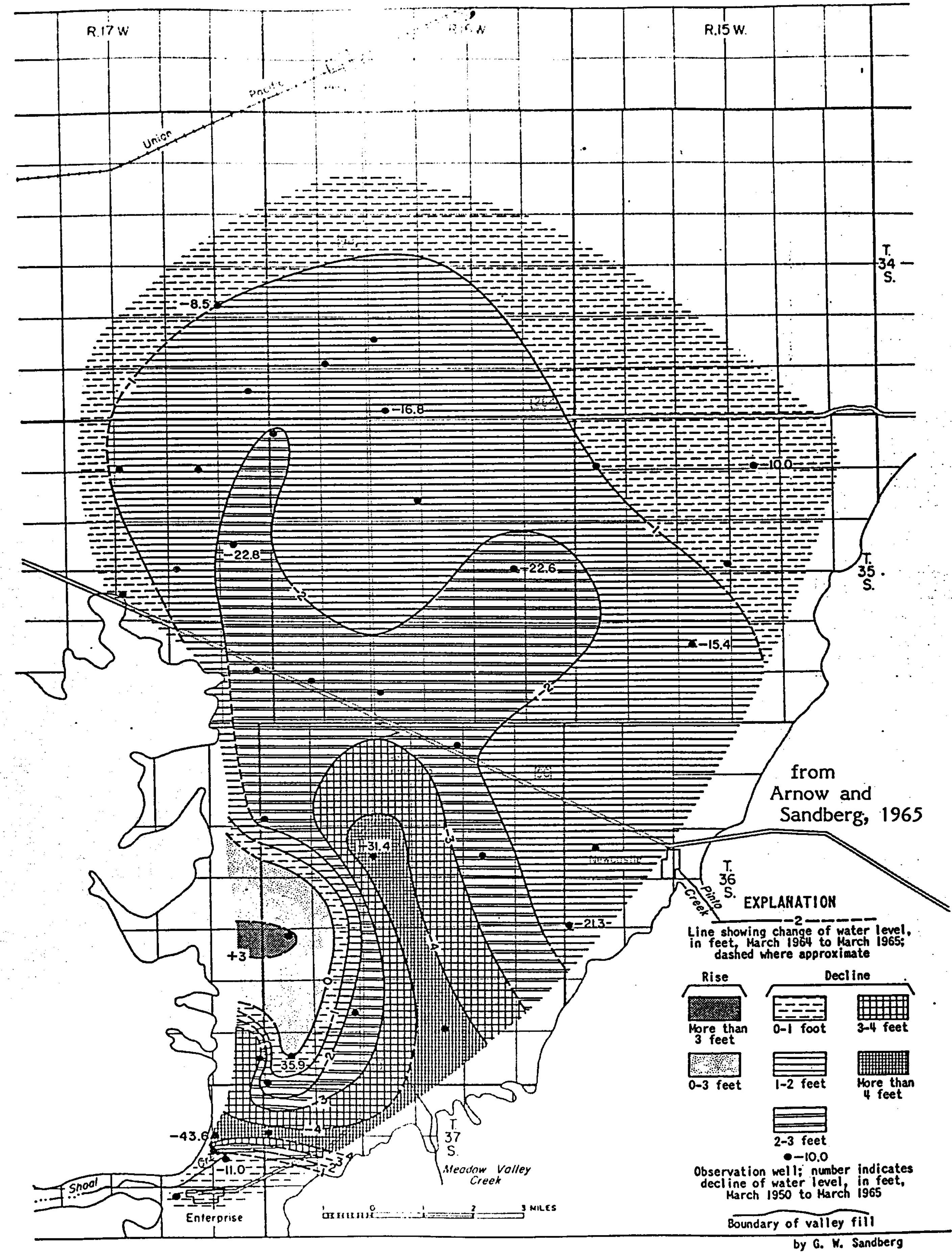
Map of the Beryl-Enterprise district showing changes of water levels, March 1963 to March 1964, and declines in selected wells from March 1950 to March 1964.

Fig. 14



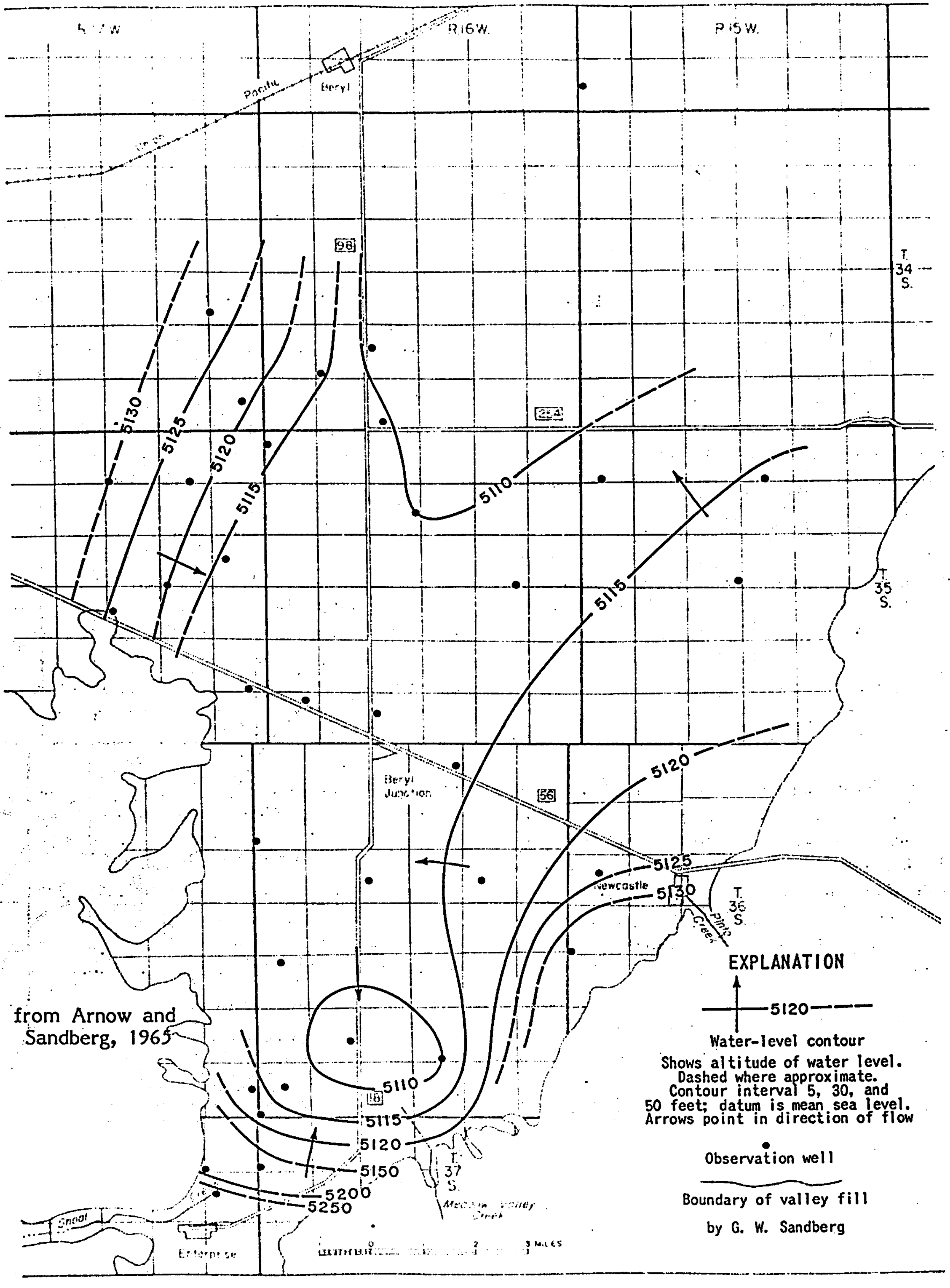
— Map of the Beryl-Enterprise district, Escalante Valley, showing water-level contours, October 1964.

Fig. 15



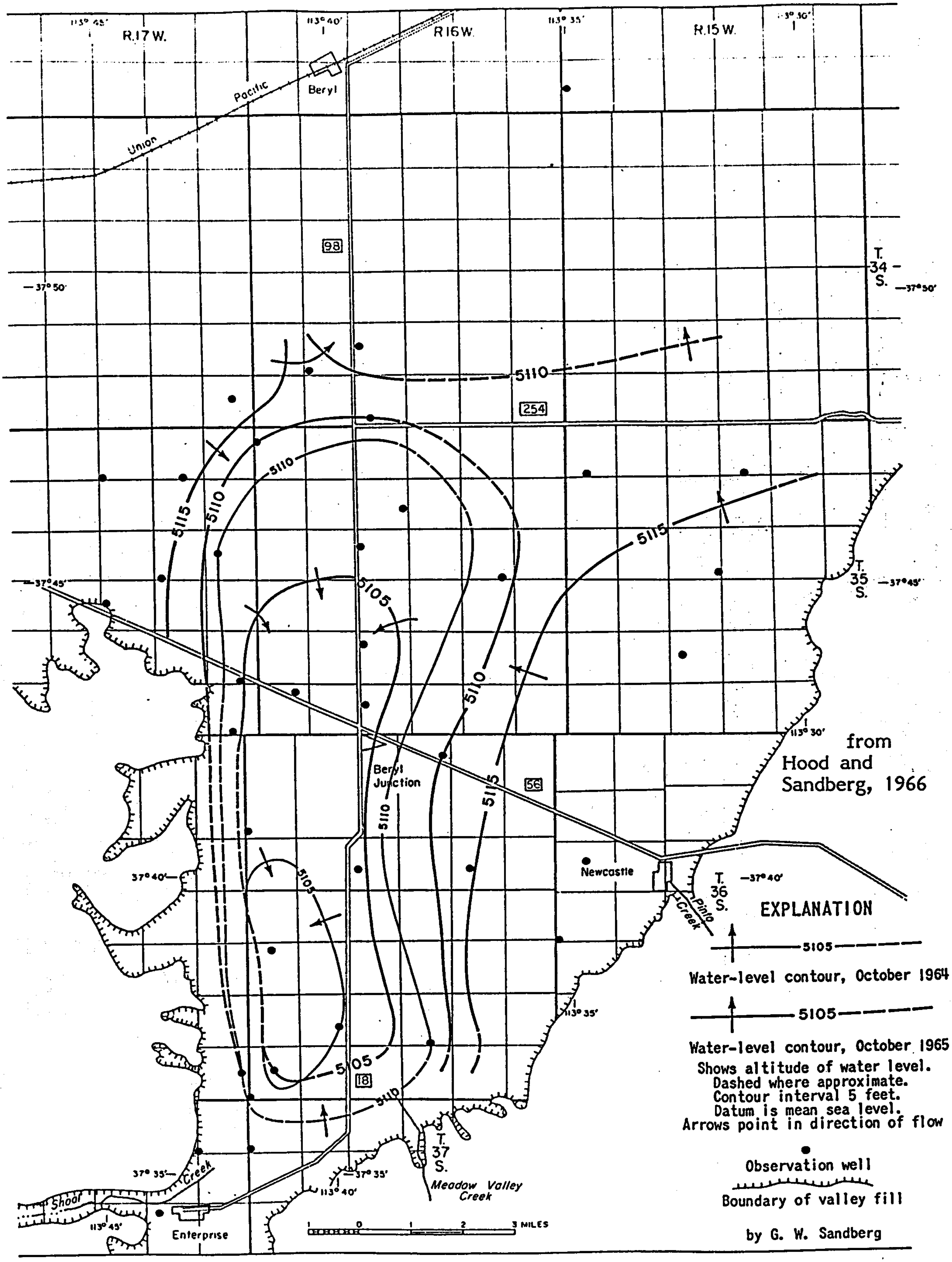
—Map of the Beryl-Enterprise district, Escalante Valley, showing change of water levels, March 1964 to March 1965.

Fig. 16

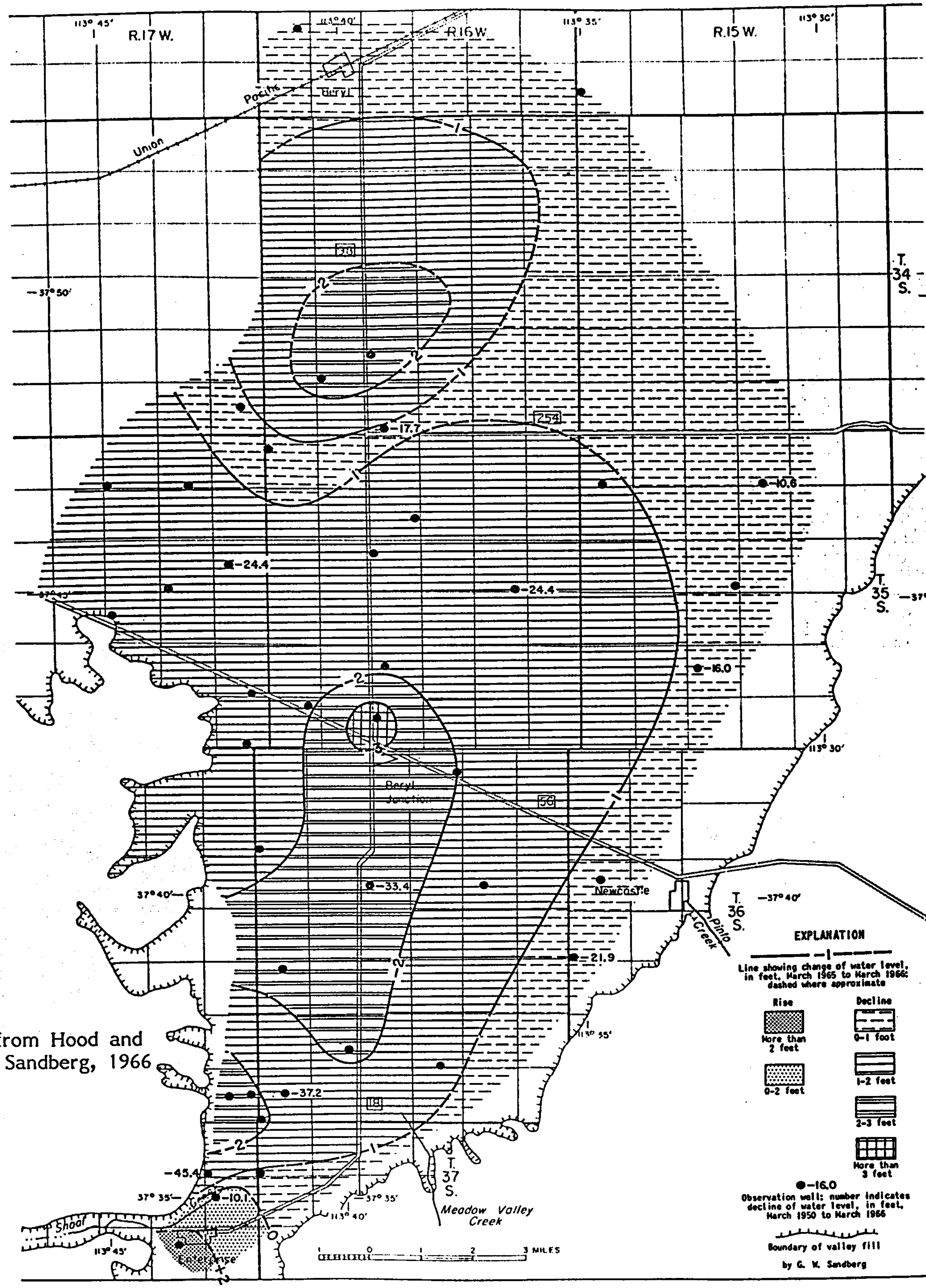


— Map of the Beryl-Enterprise district, Escalante Valley, showing water-level contours, March 1965.

Fig. 17



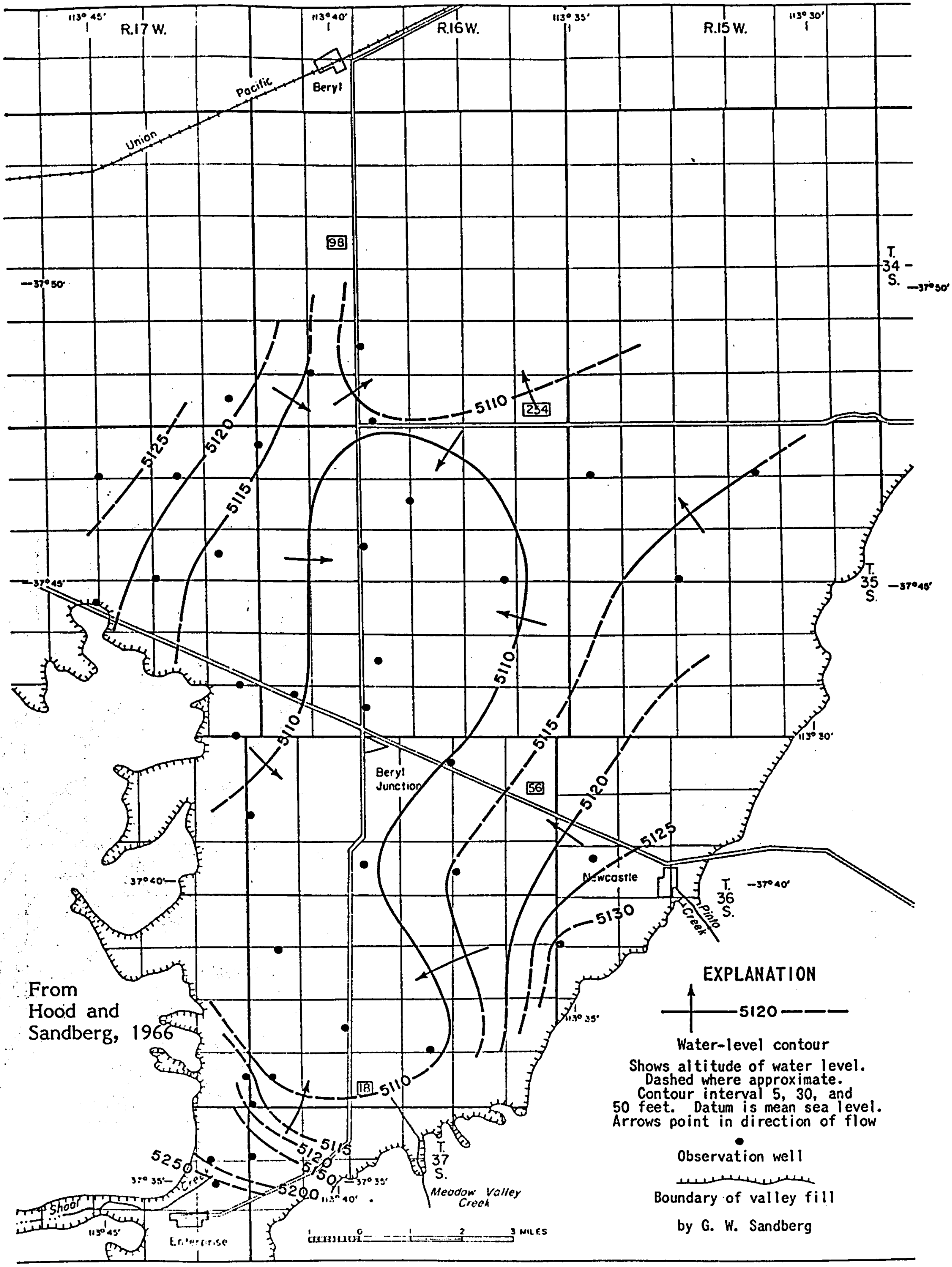
—Map of the Beryl-Enterprise district, Escalante Valley, showing water-level contours, October 1964 and October 1965. Fig. 18



from Hood and Sandberg, 1966

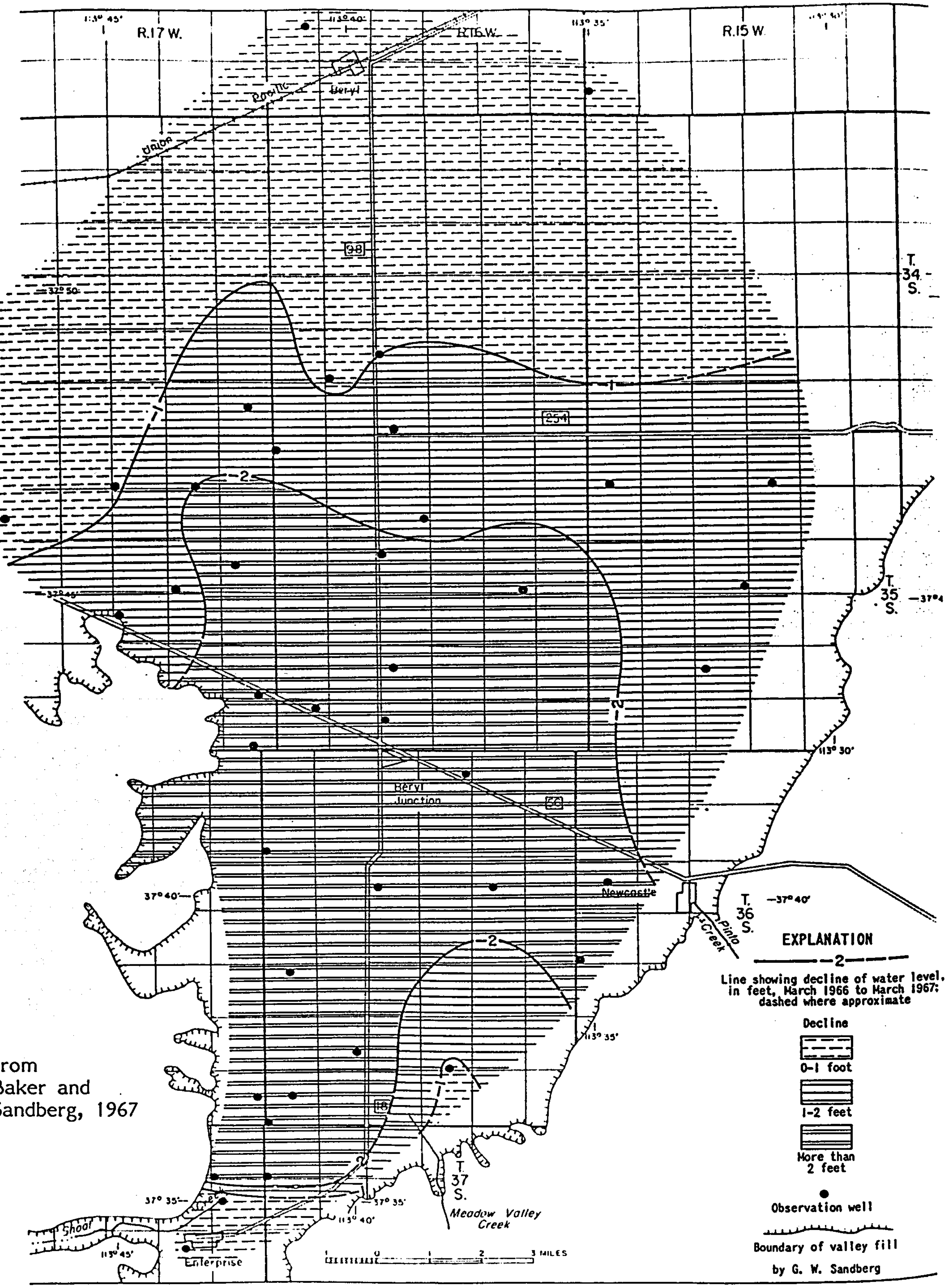
— Map of the Beryl-Enterprise district, Escalante Valley, showing change of water levels, March 1965 to March 1966.

Fig. 19

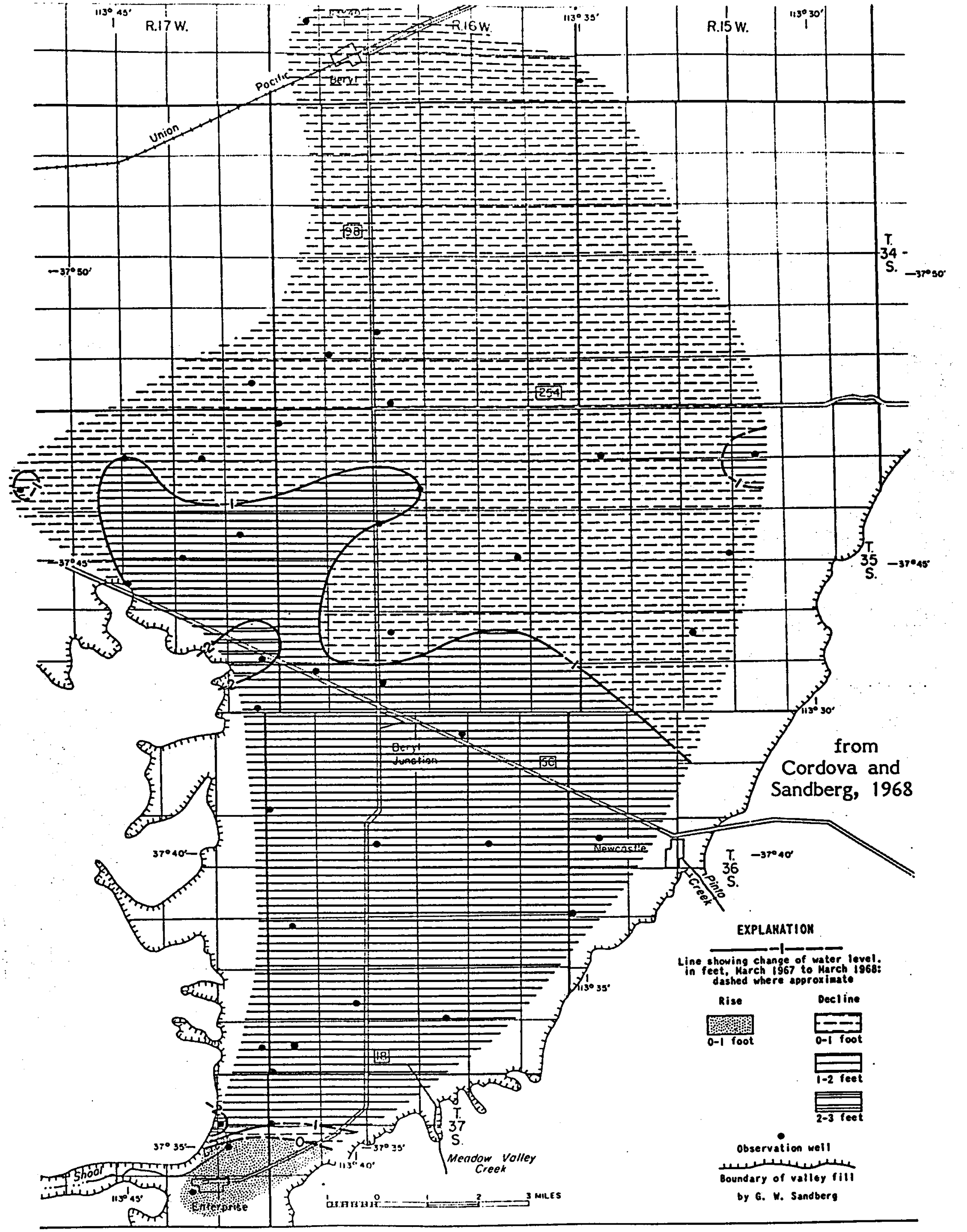


— Map of the Beryl-Enterprise district, Escalante Valley, showing water-level contours, March 1966.

Fig. 20



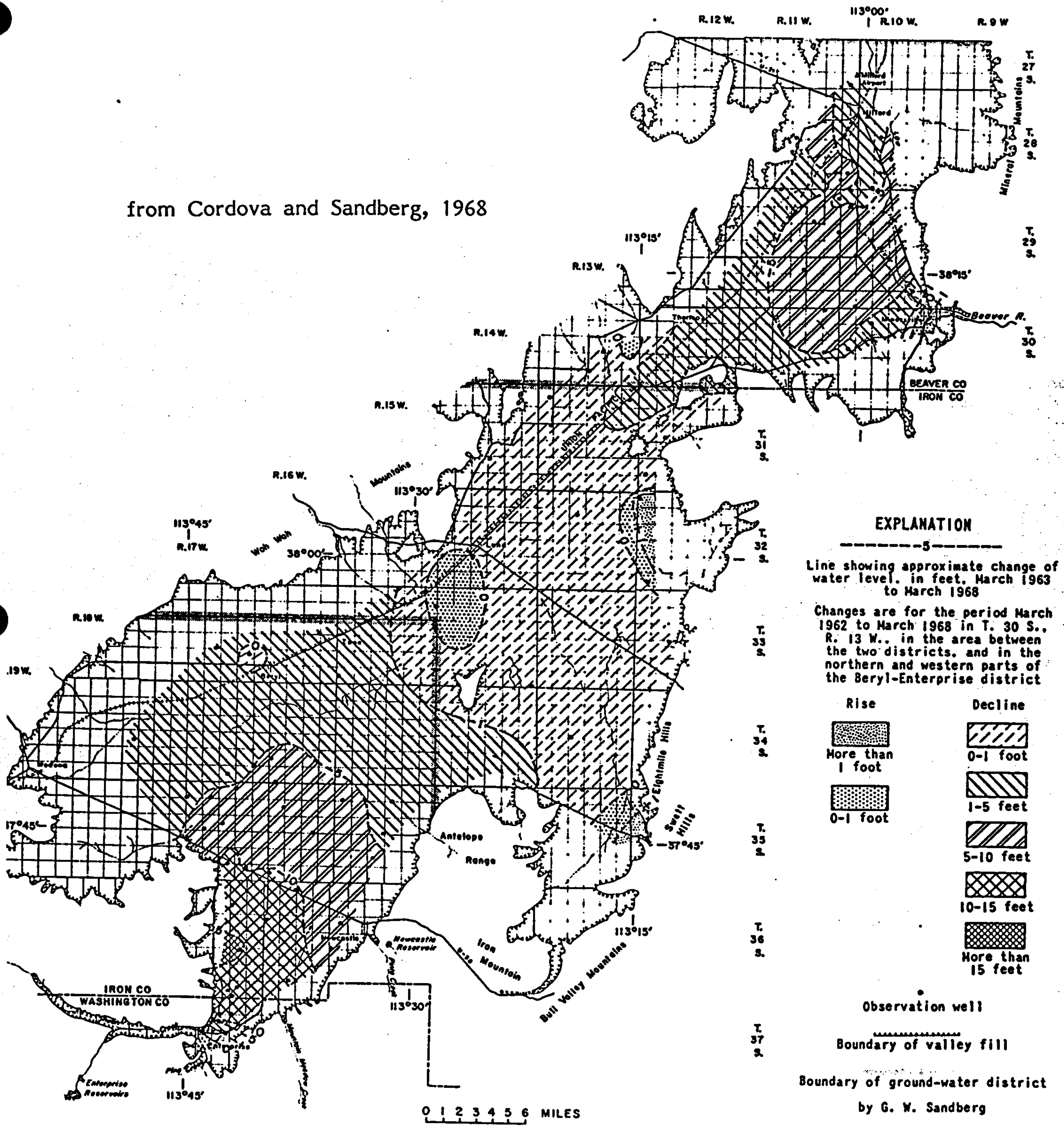
—Map of the Beryl-Enterprise district, Escalante Valley, showing change of water levels from March 1966 to March 1967. Fig. 21



—Map of the Beryl-Enterprise district, Escalante Valley, showing change of water levels from March 1967 to March 1968.

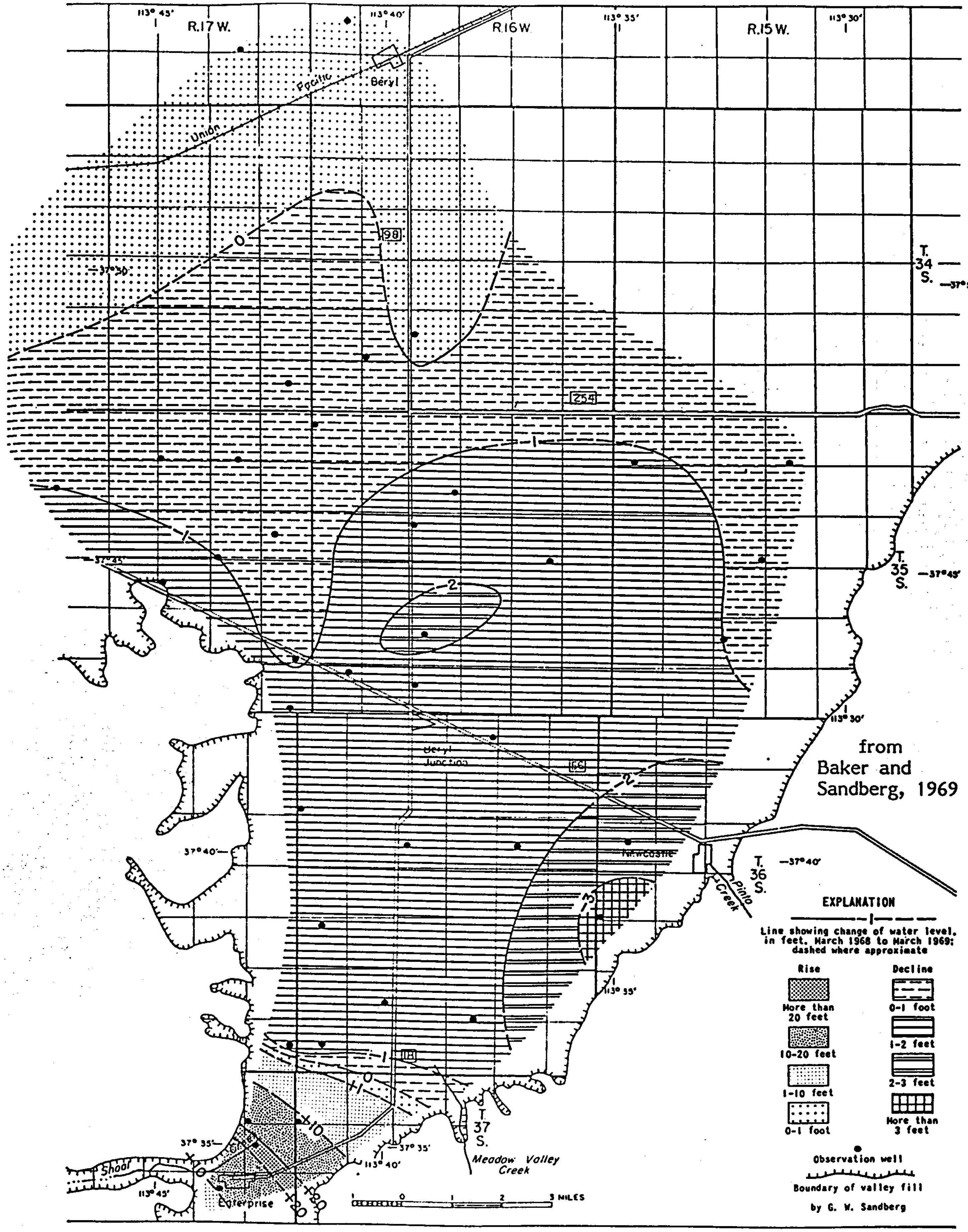
Fig. 22

from Cordova and Sandberg, 1968



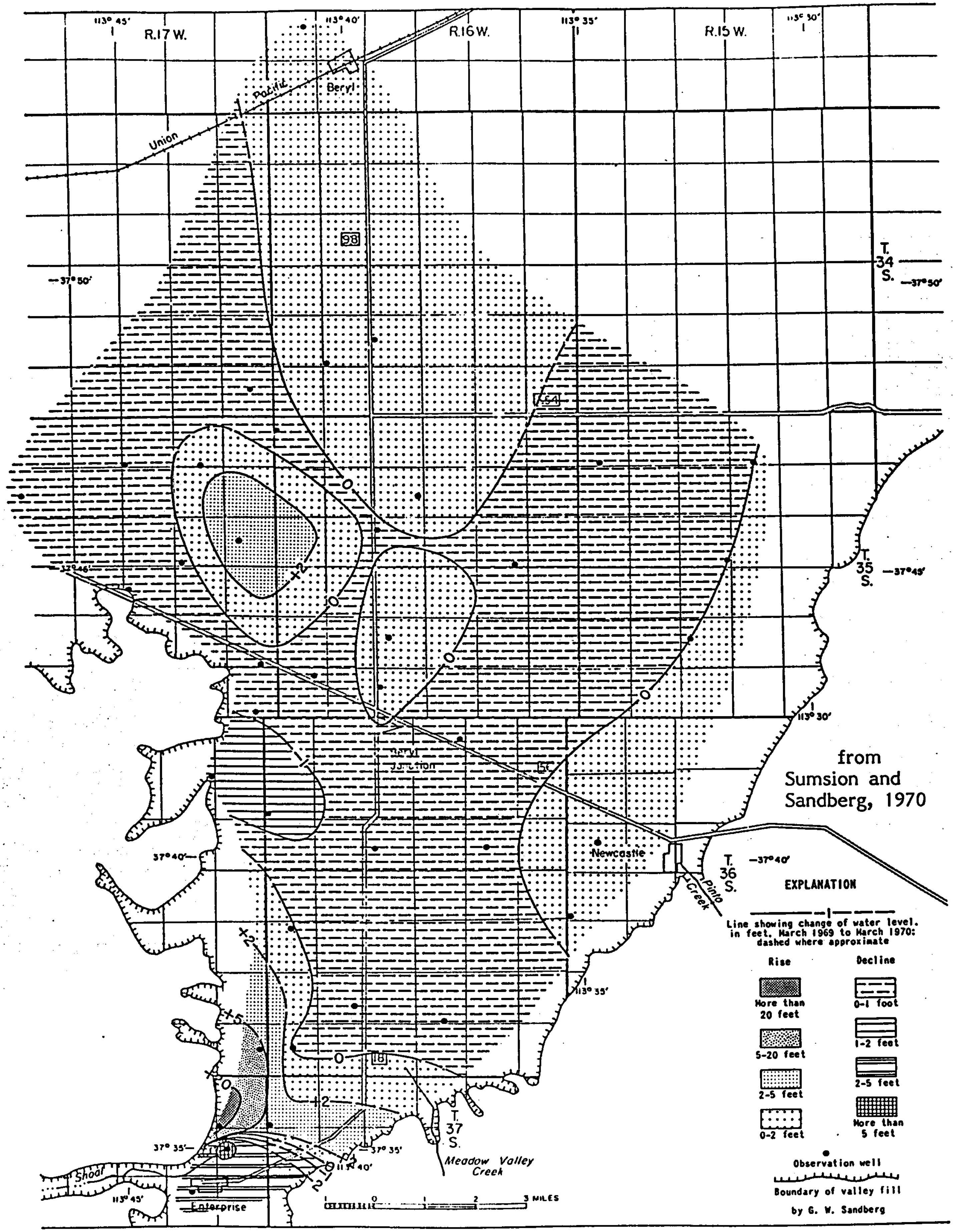
— Map of Escalante Valley showing change of water levels from March 1963 to March 1968.

Fig. 23



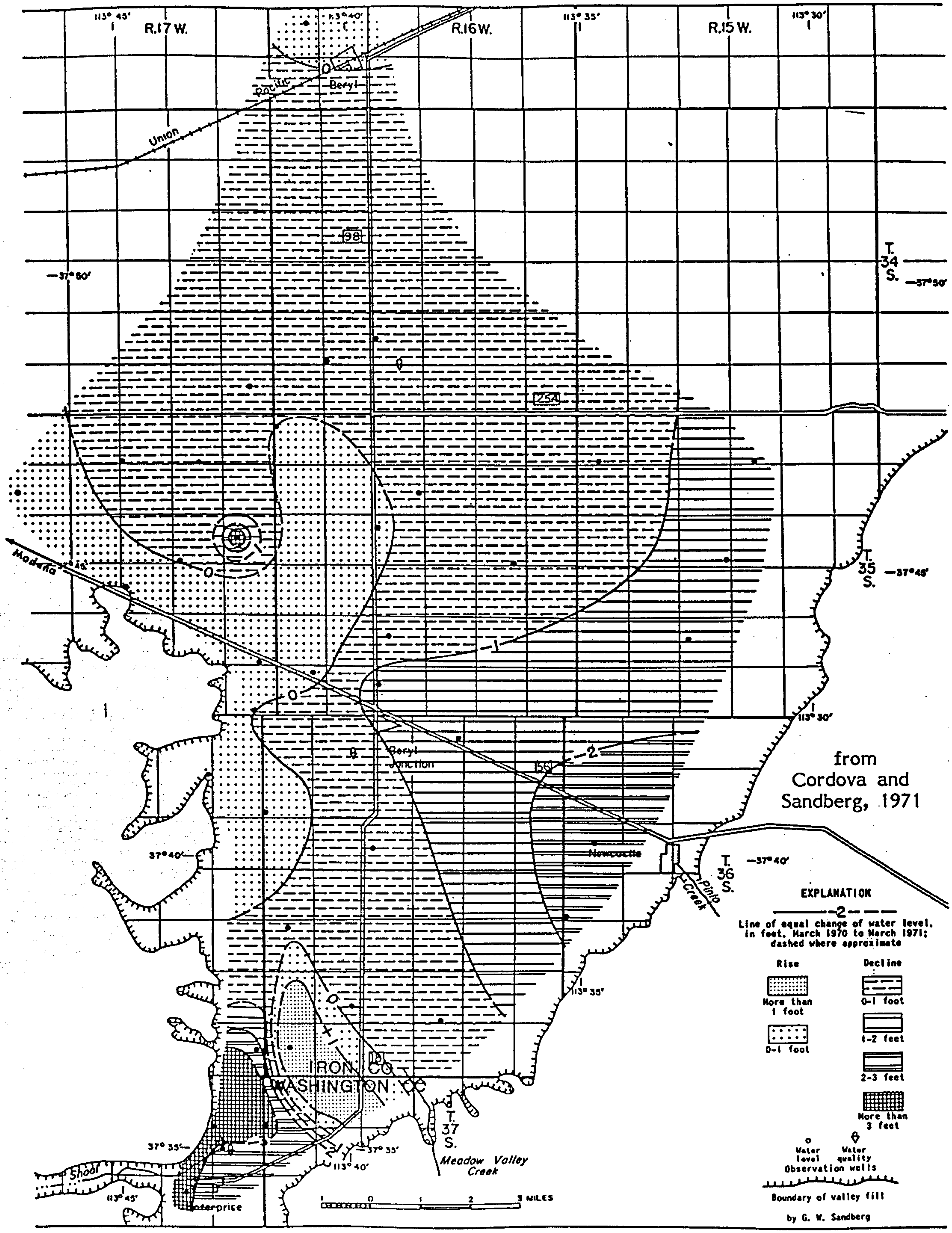
—Map of the Beryl-Enterprise district, Escalante Valley, showing change of water levels from March 1968 to March 1969.

Fig. 24



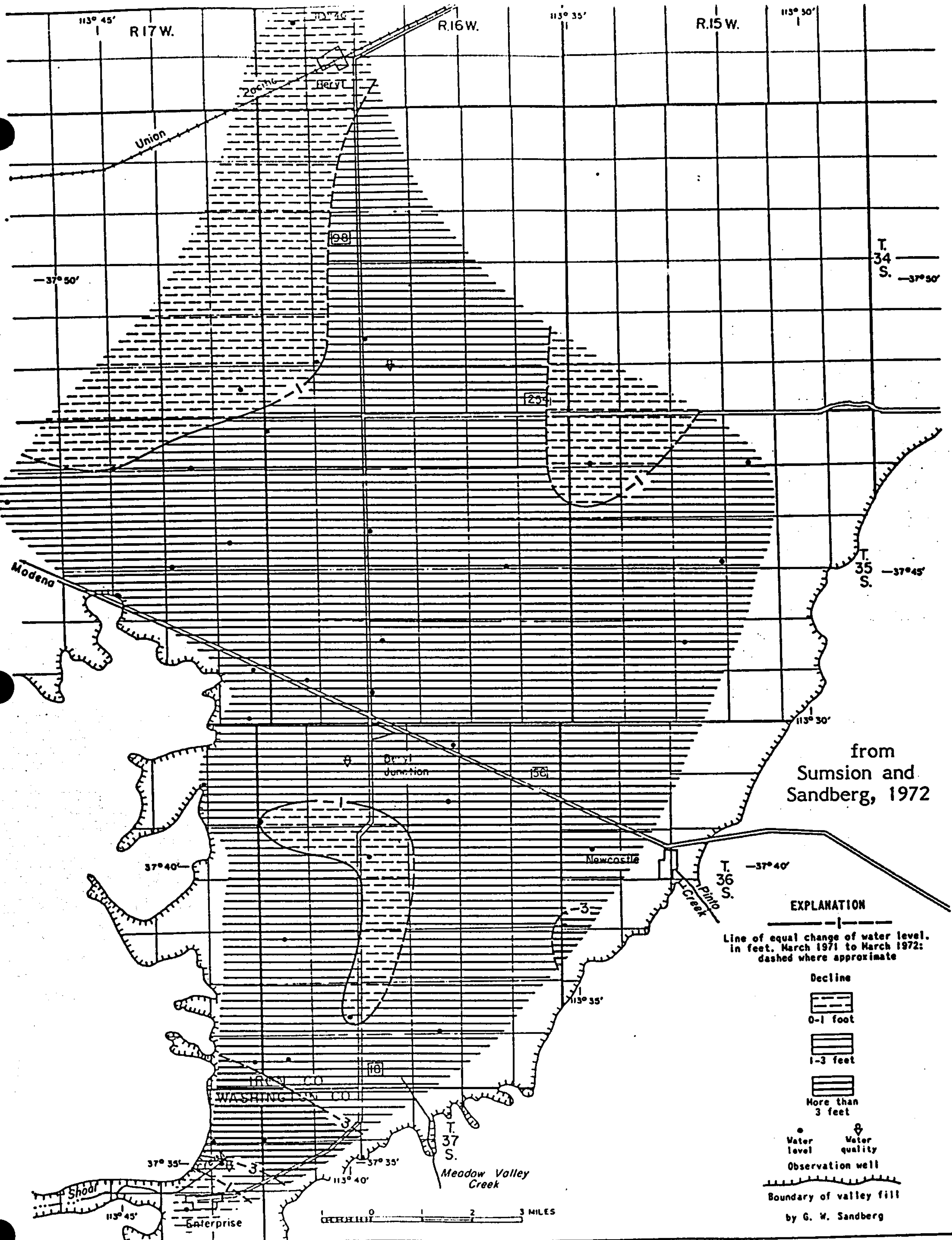
– Map of the Beryl-Enterprise district, Escalante Valley, showing change of water levels from March 1969 to March 1970.

Fig. 25



—Map of the Beryl-Enterprise district, Escalante Valley, showing change of water levels from March 1970 to March 1971.

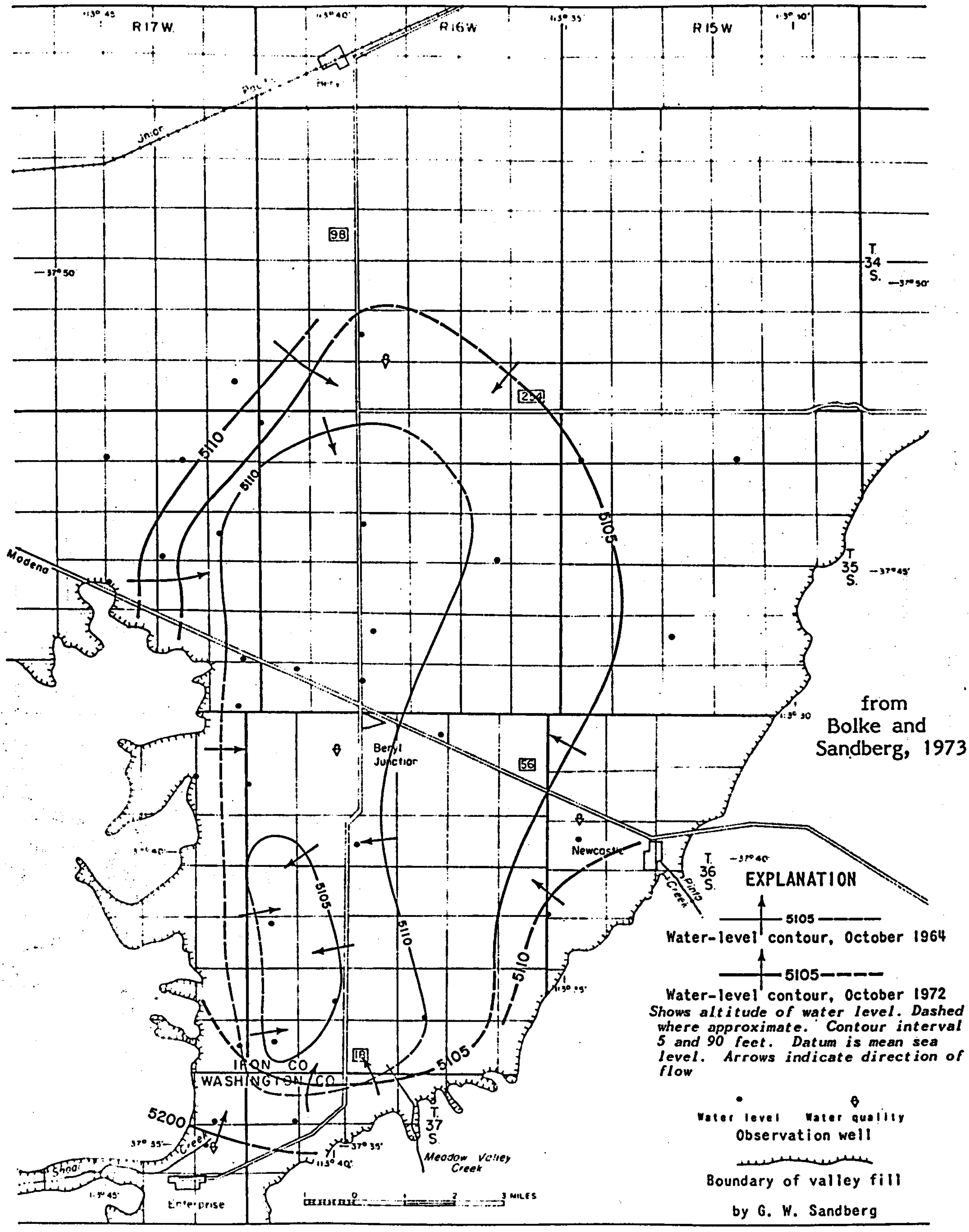
Fig. 26



from Sumsion and Sandberg, 1972

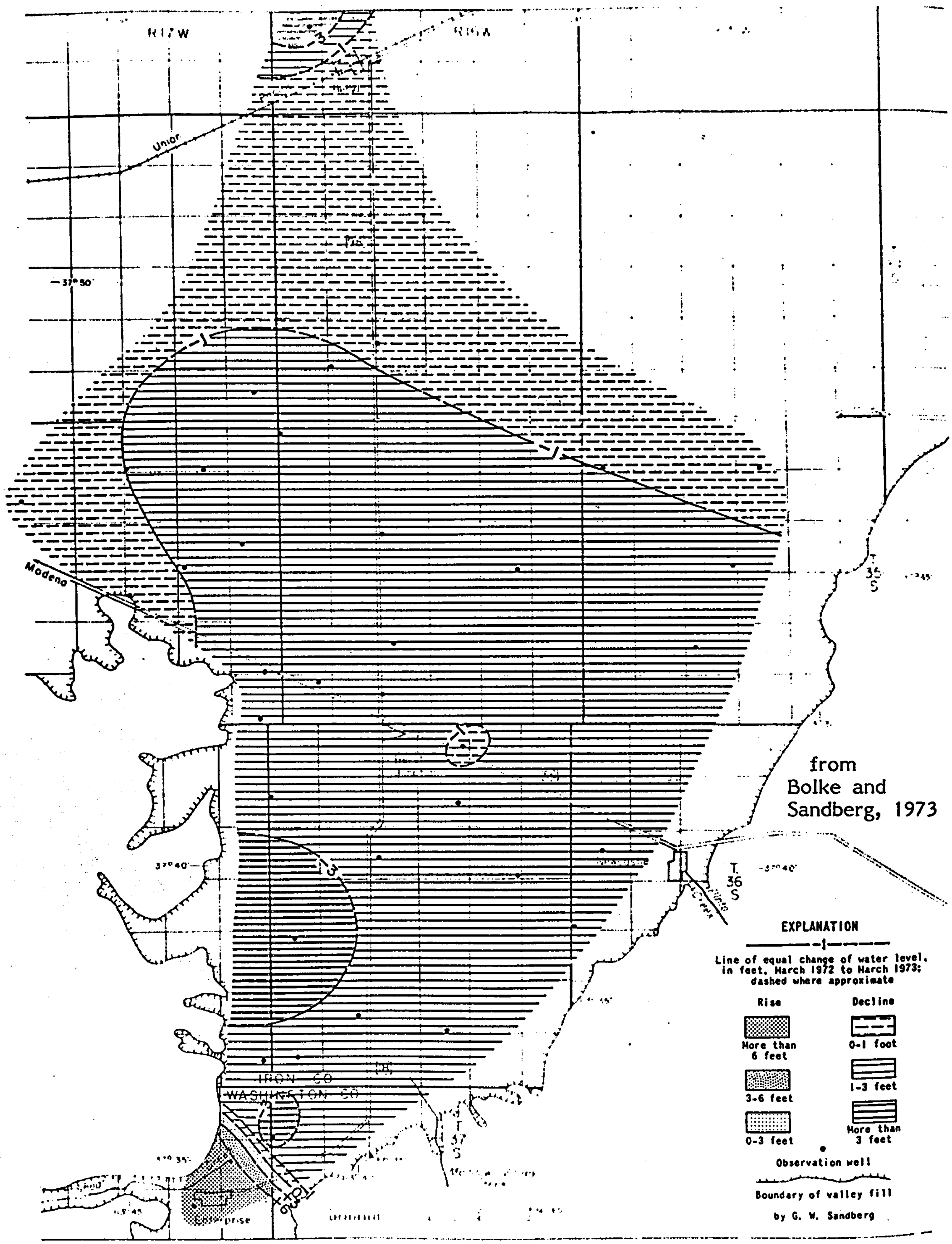
—Map of the Beryl-Enterprise district, Escalante Valley, showing change of water levels from March 1971 to March 1972.

Fig. 27



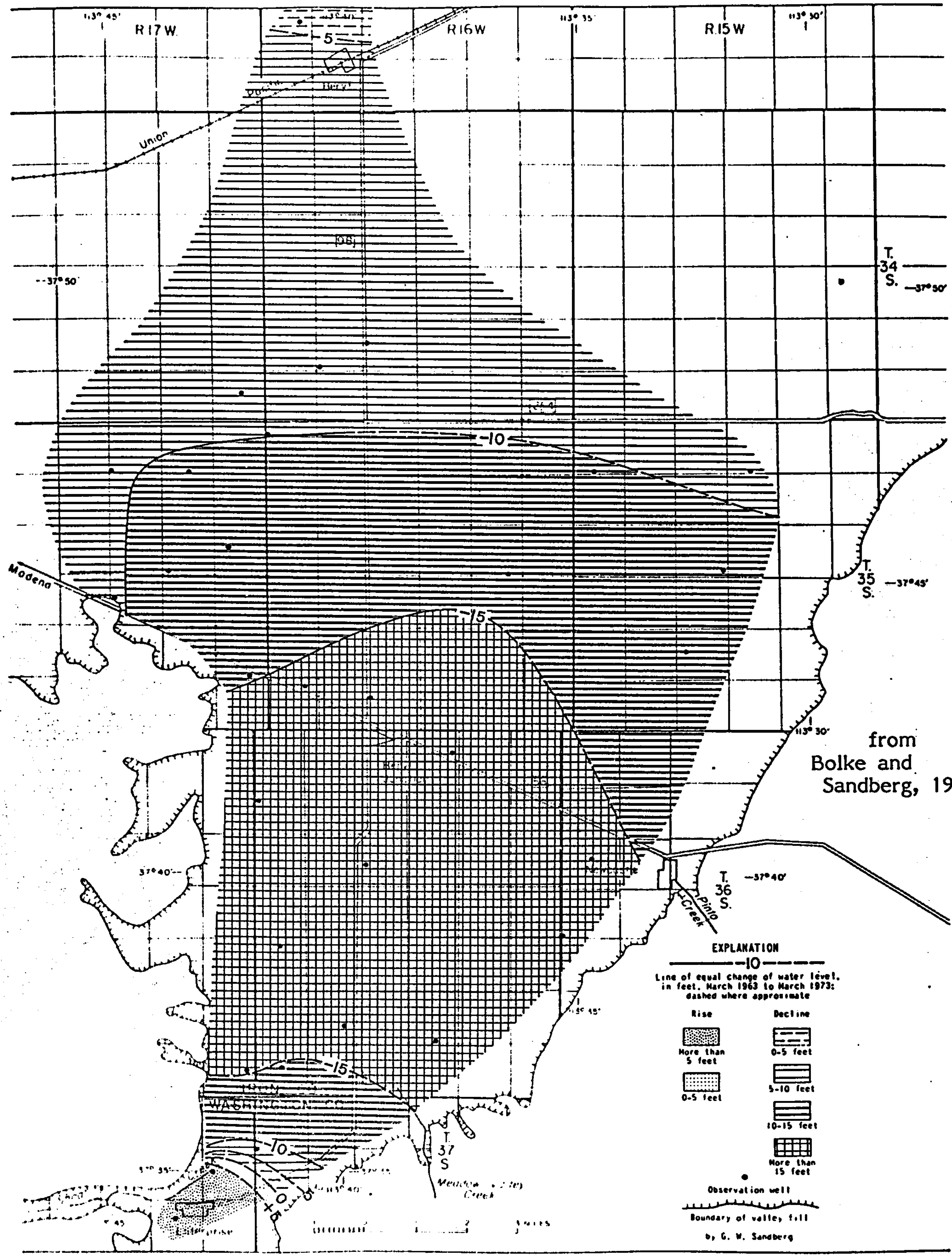
— Map of the Beryl-Enterprise district, Escalante Valley, showing water-level contours, October 1964 and October 1972.

Fig. 28



— Map of the Beryl-Enterprise district, Escalante Valley, showing change of water levels from March 1972 to March 1973.

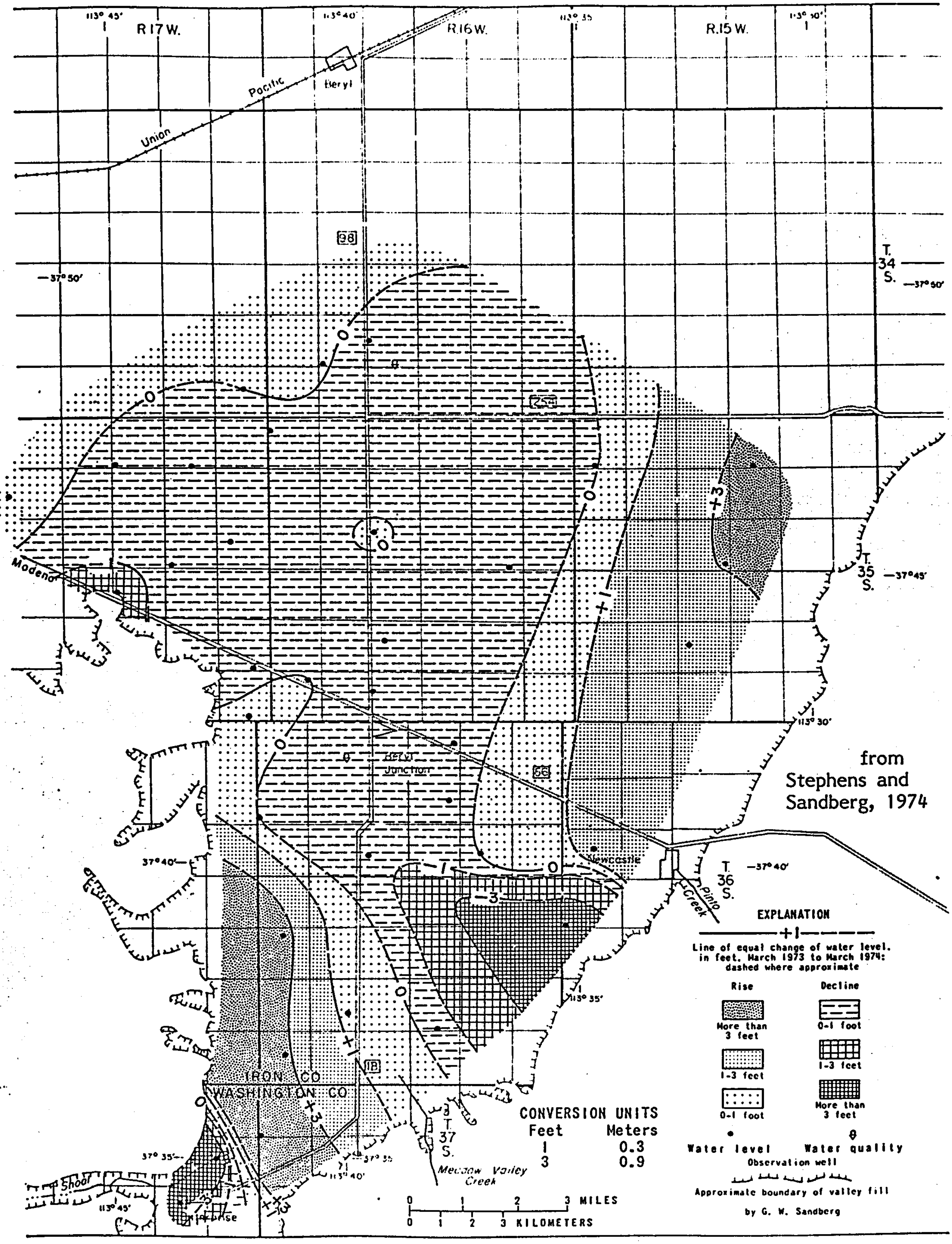
Fig. 29



from Bolke and Sandberg, 1973

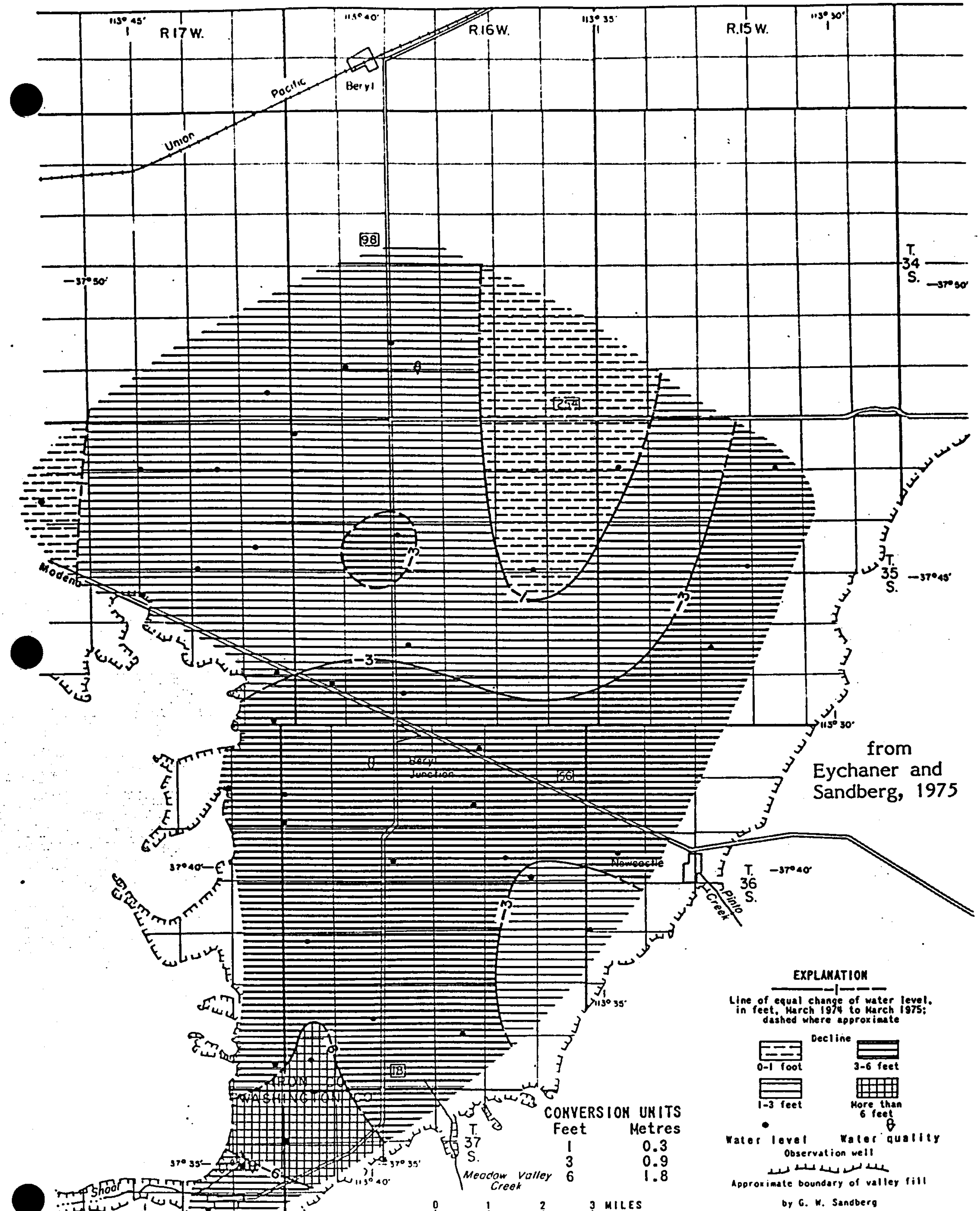
— Map of the Beryl-Enterprise district, Escalante Valley, showing change of water levels from March 1963 to March 1973.

Fig. 30



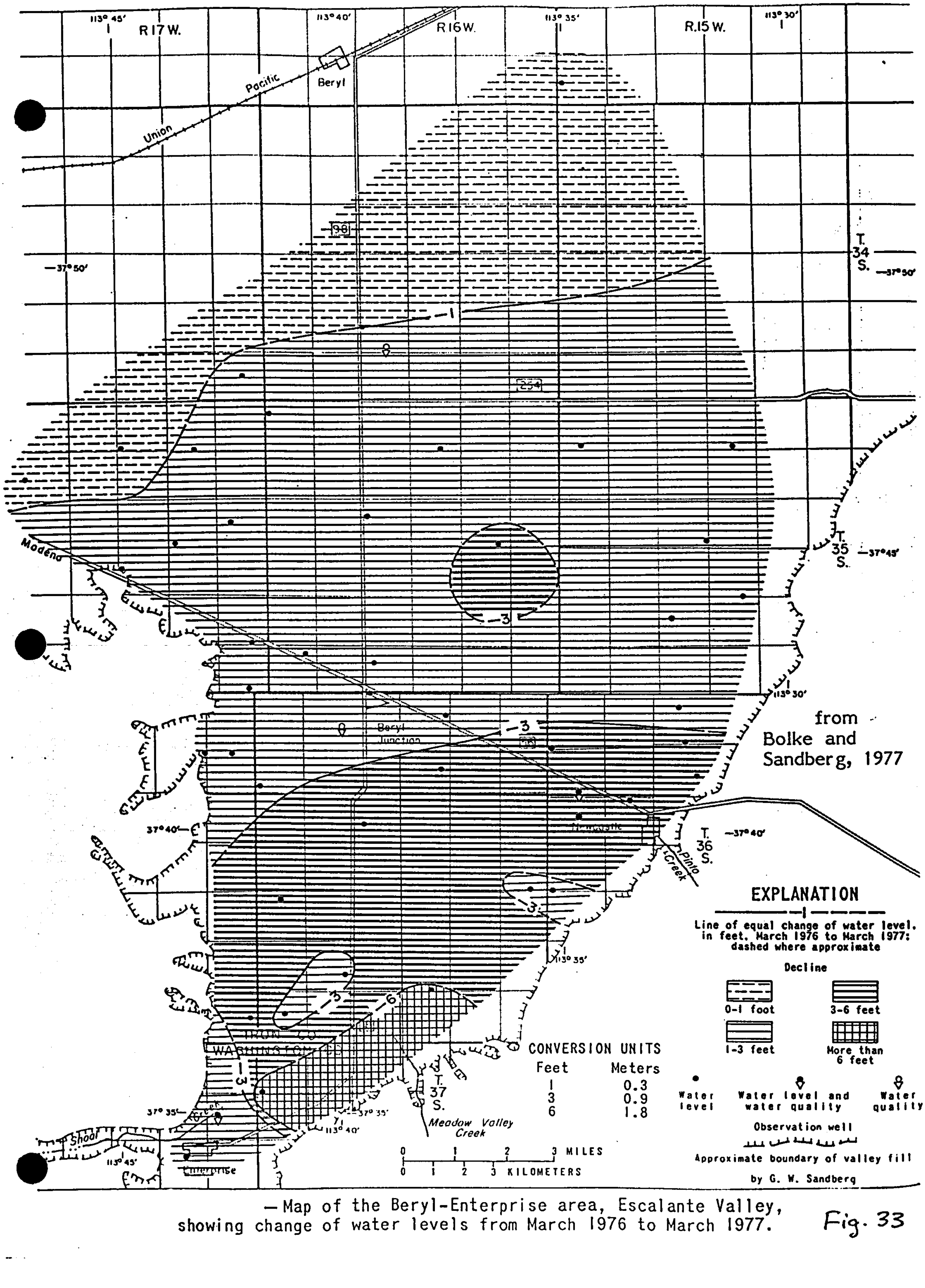
— Map of the Beryl-Enterprise area, Escalante Valley, showing change of water levels from March 1973 to March 1974.

Fig. 31



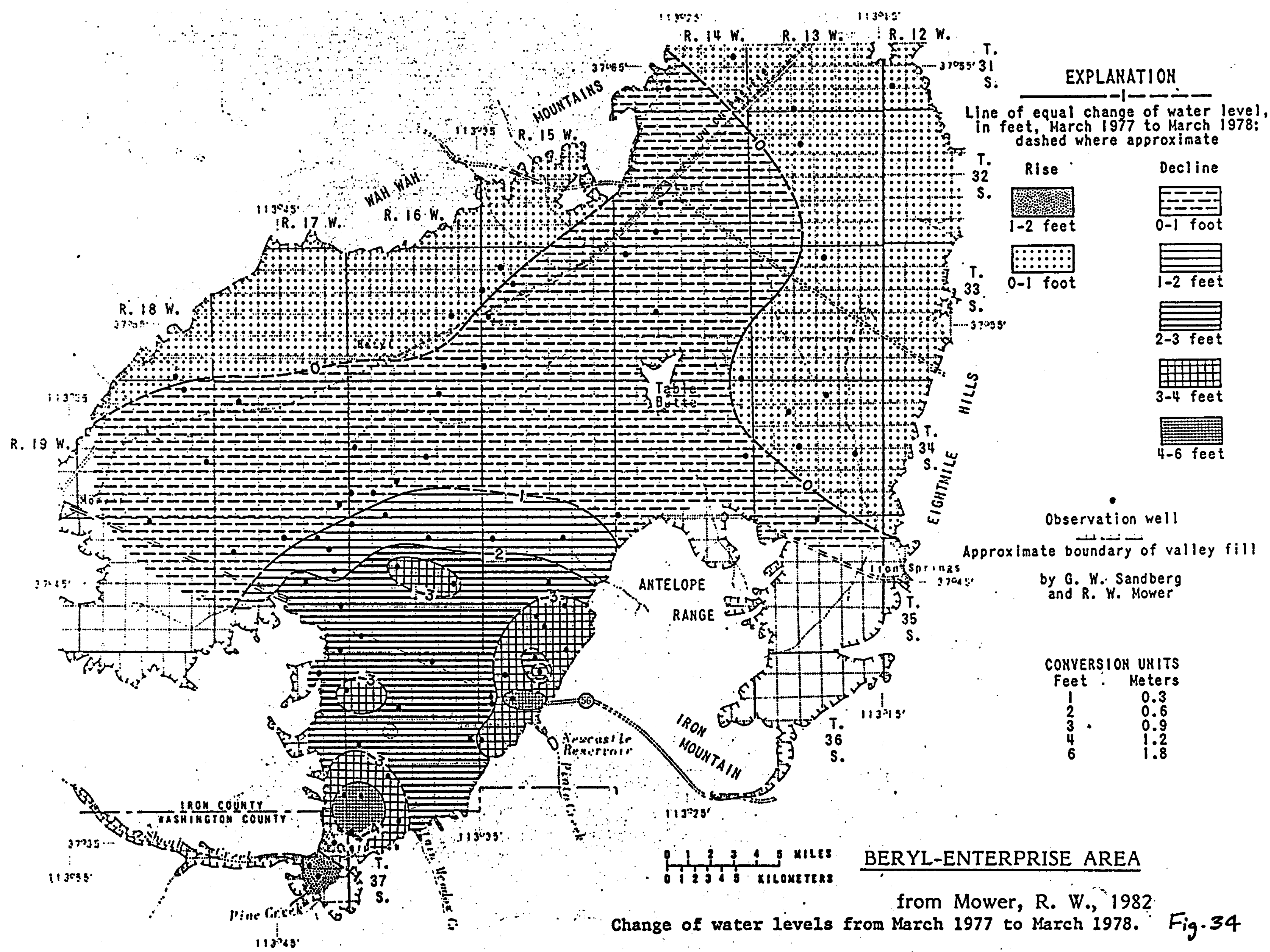
— Map of the Beryl-Enterprise area, Escalante Valley, showing change of water levels from March 1974 to March 1975.

Fig. 32



— Map of the Beryl-Enterprise area, Escalante Valley, showing change of water levels from March 1976 to March 1977.

Fig. 33



BERYL-ENTERPRISE AREA

from Mower, R. W., 1982

Change of water levels from March 1977 to March 1978. Fig. 34